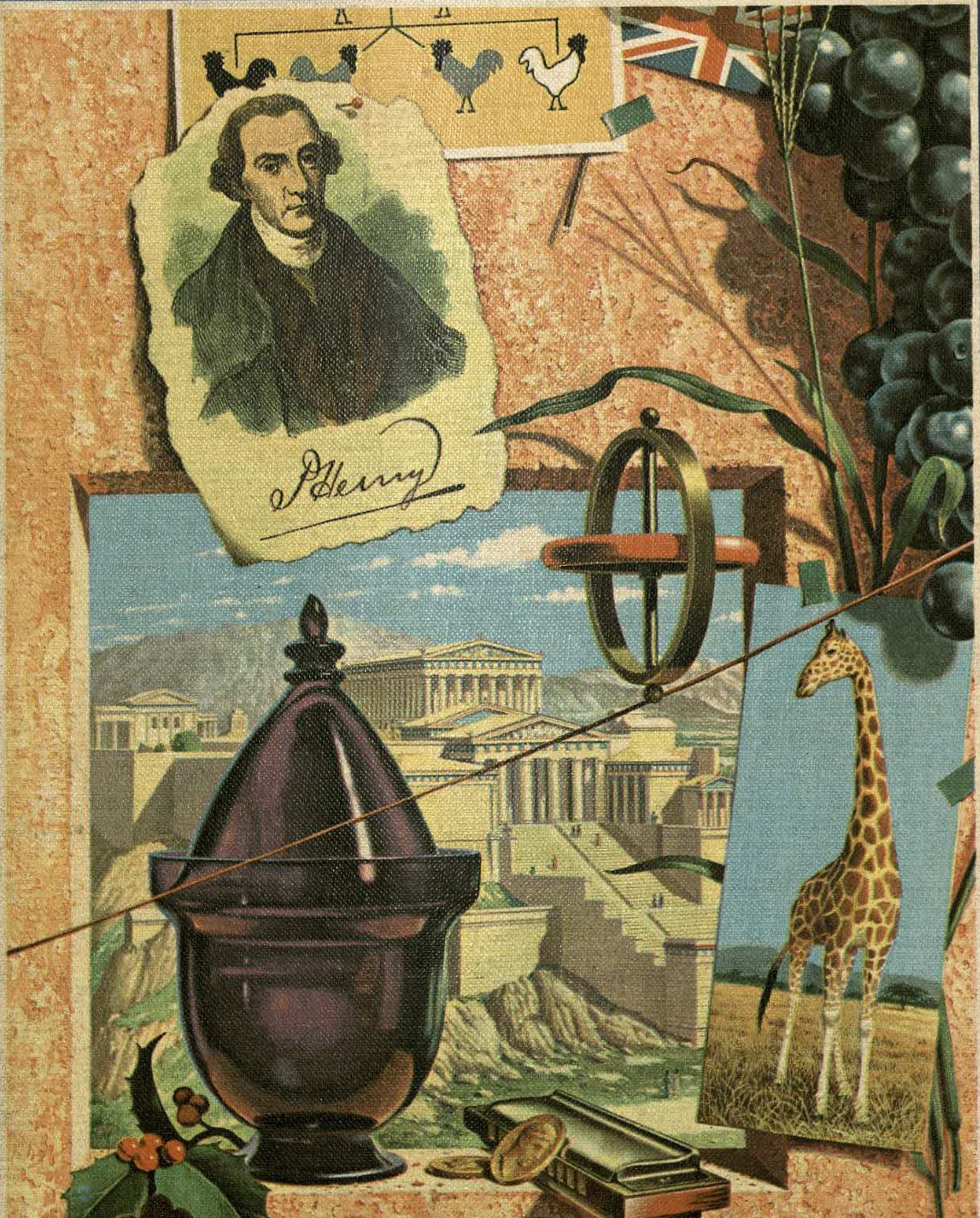
Volume 7 Ghost to Houston

The GOLDEN BOOK ENCYCLOPEDIA

REVISED EDITION



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The GOLDEN BOOK ENCYCLOPEDIA

NEW REVISED EDITION

VOLUME 7—GHOST TO HOUSTON

IN SIXTEEN ACCURATE, FACT-FILLED VOLUMES
DRAMATICALLY ILLUSTRATED WITH MORE
THAN 6,000 COLOR PICTURES

* * *

ESPECIALLY DESIGNED FOR
YOUNG GRADE-SCHOOL CHILDREN
ACCURATE AND AUTHORITATIVE
ENTERTAININGLY WRITTEN AND ILLUSTRATED
TO MAKE LEARNING AN ADVENTURE

BY BERTHA MORRIS PARKER
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RESEARCH ASSOCIATE, FIELD MUSEUM OF NATURAL HISTORY

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Ghost to Houston

GHOST No one ever really saw or heard a ghost. There are no true haunted houses. But many people think that they have seen or heard ghosts. And many people have moved away from houses because they thought that the houses were haunted.

This is the true story of one "haunted" house: No one lived in this house. Many people who drove past it at night reported that they saw a ghost run through the house from front to back with a lighted lamp. They did not actually see the ghost itself, but they could see the flickering light of its lamp shining out of first one window and then another.

Someone finally tracked down this ghost. It turned out that the old house had wavy glass in its windows. When the light from a car struck the windows, the wavy glass reflected it in a peculiar way.

Ghosts are supposed to be the spirits of dead people. They are supposed to look much as they looked when they were alive except that often they have no heads. They are supposed to be able to go through locked doors or closed windows and to talk, but with queer spooky voices.

There are some famous ghosts that are "seen" rather often. Many old castles in England and Scotland are "haunted." Of course, if anyone is told that a ghost will appear, he easily imagines that he sees it, especially at night in pale moonlight.

One of England's most famous ghosts is the ghost of Dick Turpin, a notorious English highwayman. People say that it gallops down a steep hill three times a year. The ghost of Sir Francis Drake has been seen many times riding in a black coach drawn by headless horses. Scotland has its giant red-haired ghost of Glamis Castle.

Shakespeare put ghosts in some of his plays. In *Hamlet,* for instance, there is the ghost of Hamlet's father. In Dickens' *Christmas Carol* the ghost of Marley appears to the miserly Scrooge. Other writers, too, have put ghosts in their plays and stories. The famous composer Wagner wrote an opera called *The Flying Dutchman* about a phantom ship with a ghostly crew. Ghosts are fun to read about even though we know there are no real ones. (See MYTHS AND LEGENDS; SUPERSTITIONS.)

GIANT Many of our favorite stories have giants in them. There are, for instance, many giants in Greek myths. Atlas held the world on his shoulders. Prometheus brought fire to the earth. Both Atlas and Prometheus were Titans, all of whom were giants. Cyclops was a one-eyed giant in Greek myths. In Norse myths the frost giants waged an unending war with both gods and men.

The Bible tells the story of how the young David killed Goliath with a slingshot. Goliath was a giant.

In *Gulliver's Travels* Gulliver visited a whole country of giants—the Brobdingnagians. The giant in *Jack and the Beanstalk* and the ogre in *Hop o' My Thumb* are other well-known storybook giants.

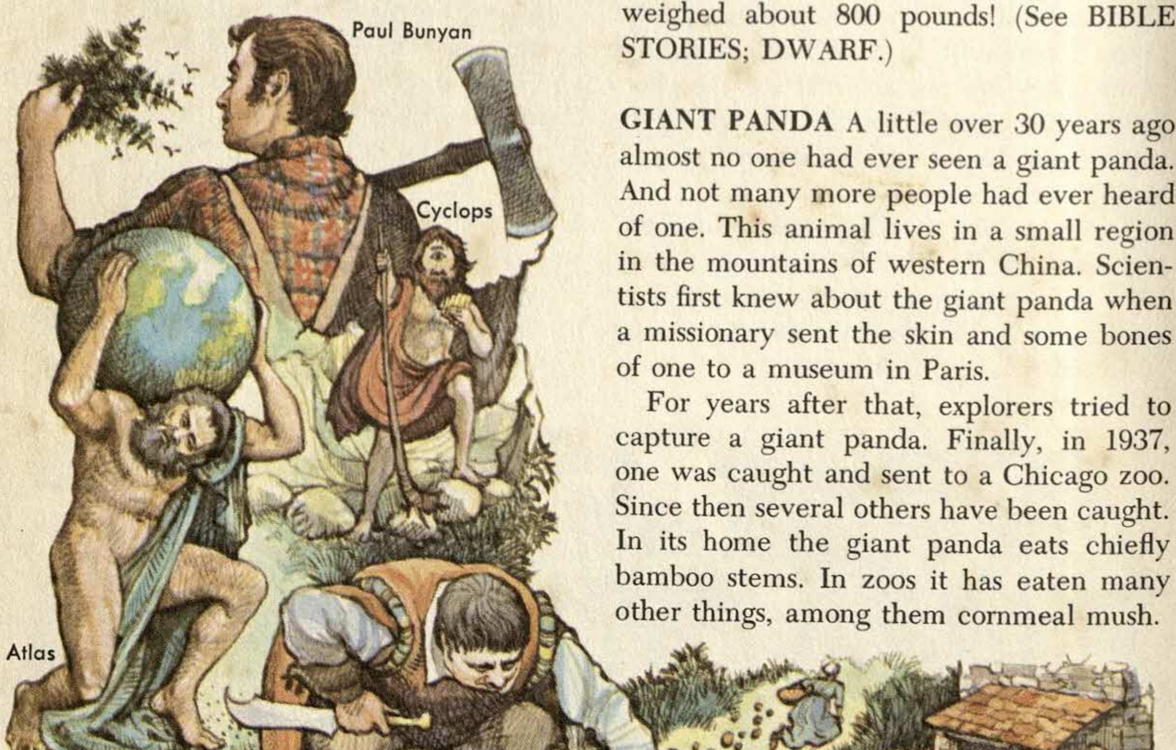
Every country has tales of its own giants. Among the legends of the United States, for instance, are many about Paul Bunyan, a giant, and his amazing feats.

There are no giants in real life as big as storybook giants. We have giants today—men and boys more than 6½ feet tall and women over 6 feet, 1½ inches. Many of the players on basketball teams are so tall they are giants. But these tall people do not have the great weight and strength of the giants of storybooks.

Scientists know now that a tiny gland in the head has a great deal to do with a person's size. This gland is the pituitary gland. If a person is much taller than his fellows, he can, as a rule, give his pituitary gland the credit—or the blame.

In many stories of giants, the giants are bad tempered and cruel. Actually a person's size does not have anything to do with his disposition.

Some early men were giants. In China and Java scientists have found their bones and teeth. One of these giants, it is thought, was twice as big as a large gorilla and weighed about 800 pounds! (See BIBLE STORIES; DWARF.)



GIANT PANDA A little over 30 years ago almost no one had ever seen a giant panda. And not many more people had ever heard of one. This animal lives in a small region in the mountains of western China. Scientists first knew about the giant panda when a missionary sent the skin and some bones of one to a museum in Paris.

For years after that, explorers tried to capture a giant panda. Finally, in 1937, one was caught and sent to a Chicago zoo. Since then several others have been caught. In its home the giant panda eats chiefly bamboo stems. In zoos it has eaten many other things, among them cornmeal mush.

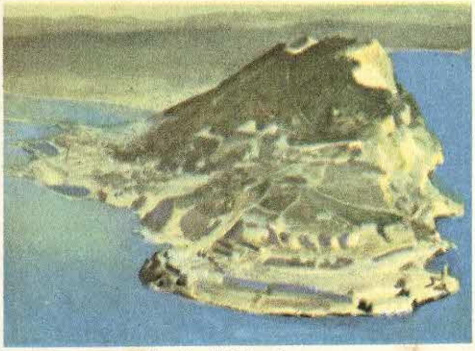
A giant panda looks like a big stuffed toy. It is a clown and goes through amusing antics. In a zoo the animal always has a crowd around it.

Scientists found the giant panda a puzzle. After much studying they decided that it was a distant cousin of the raccoon. Now, however, some scientists think that it is just what it looks to be—a bear, but one of a very primitive kind.

GIBRALTAR Both a strait and a "rock" have the name of Gibraltar. The Strait of Gibraltar is the gateway from the Atlantic Ocean into the Mediterranean Sea. It separates Europe from Africa. The Rock of Gibraltar is a high, rocky point of land that reaches out into the strait from the peninsula of Spain.

In ancient times the Rock of Gibraltar was one of the Pillars of Hercules. The other pillar was Jebel Musa, a mountain across the strait on the African shore.

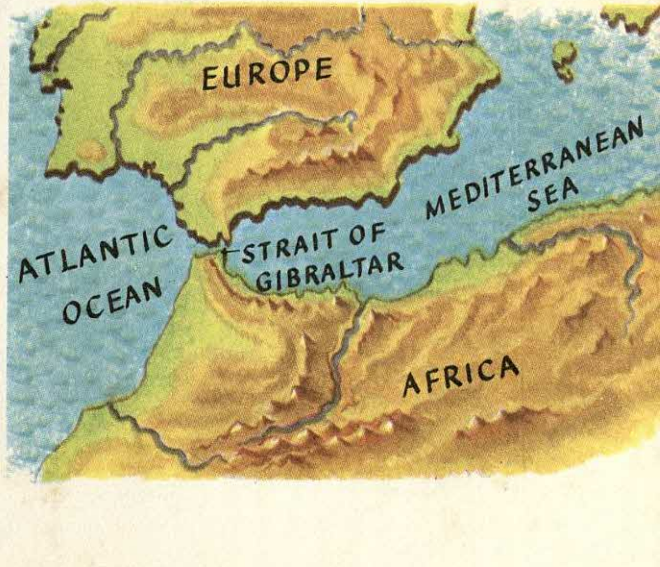
The Strait of Gibraltar is about 8 miles wide at its narrowest point. At its widest point it measures about 23 miles. It is a part of one of the most traveled seaways in the world. Ships go through this strait on their way from western Europe and the Americas to southern Europe, northern Africa, and western Asia. The building of the Suez Canal to join the Mediterranean with the Red Sea made the Strait of Gibraltar also a part of the shortest water route from western Europe and eastern North America to the Far East.



Rock of Gibraltar

The Spaniards and the Moors fought over the Rock of Gibraltar for several centuries. But in 1704 the British and Dutch seized it. A few years later, in 1713, Britain was given full possession of it by the terms of the Treaty of Utrecht. The Rock of Gibraltar still belongs to Britain.

The Rock is only about 2½ miles long and ¾ of a mile wide. But during a war the country that owns it can keep the ships of an enemy from passing through the strait. Britain made the Rock into a great fortress. There is a harbor for warships at its base, and an airstrip on the isthmus that ties it to Spain. Spain has long wanted Gibraltar back. Talks between Britain and Spain, begun in 1966 at the direction of the United Nations, are still under way. (See BRITISH COMMONWEALTH.)



GILBERT AND SULLIVAN *The Mikado, The Pirates of Penzance,* and *H.M.S. Pinafore* are gay operettas written more than 80 years ago by two Englishmen—William S. Gilbert and Arthur Sullivan. Gilbert and Sullivan wrote a dozen or so operettas together. Gilbert wrote the words for all of them. Sullivan wrote the music. Among their other operettas are *The Gondoliers, Iolanthe, Trial by Jury,* and *The Yeomen of the Guard.*

H.M.S. Pinafore, one of their early operettas, is one of the gayest. All the action in it takes place on shipboard. "H.M.S." stands for "Her Majesty's Ship." Three of the songs in the operetta are "I'm Called Little Buttercup," "I Am the Captain of the Pinafore," and "When I Was a Lad." *Pinafore* was such a success that at one time 90 different companies were singing it. All the Gilbert and Sullivan operettas were so well liked that in London a new theater—the Savoy—was built just for them.

In these operettas there are songs called patter songs. They are not easy to sing. The words must be sung very fast but very clearly. If they are not understood, much of the fun of the operetta is lost.

There is so much gaiety in their operettas that it is hard to believe that Gilbert and Sullivan did not always enjoy working together. But they did not; they often quarreled. At last they became so angry with each other that they decided to give up working as a team.

They wrote their last operetta together in 1896. But their operettas are still popular. In the United States there are about 5,000 performances every year. In other countries there are many, too.

GINGERBREAD TREE The doom palm grows in Egypt and some of the lands nearby. Another name for it is gingerbread tree. This palm has a red fruit about the size of an apple. Inside the fruit there is a single seed. The pulpy part of the fruit around the seed is good to eat. It tastes a little like gingerbread.

The fruit of the gingerbread tree has been eaten for thousands of years. It has been found in ancient Egyptian tombs. The early Egyptians made a practice of burying food with people when they died.

Ginkgo

GINKGO In America the ginkgo is often called the maidenhair tree. Its leaves are fan-shaped like the leaflets of a maidenhair fern. Although the ginkgo is a distant relative of the pines and firs, it is not an evergreen.

Ginkgo seeds have a covering of pulp with an unpleasant smell. But freed of their pulp they are good to eat.

This tree has lived on the earth for a very long time. The ginkgo trees we have now are almost exactly like their ancestors of two hundred million years ago.

Once the ginkgo had many close relatives. But they all disappeared. The ginkgo, too, would probably have disappeared if the Chinese and Japanese had not planted it in their temple gardens.

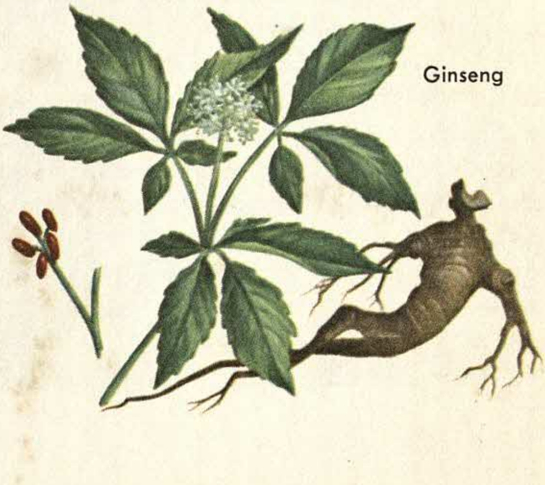
Ginkgo trees are found in many cities. They are liked chiefly because they can stand smoke and have few insect enemies.

Gingerbread Tree

GINSENG (JIN sang) The plant we call ginseng grows wild in China and Korea. It is also cultivated in the United States, Korea, and Japan.

Ginseng has pretty red berries in the fall, but the plant is not raised for them. It is raised for its roots, which are much wanted in China. They sometimes bring high prices. Wild roots bring higher prices than cultivated ones. So far as anyone knows, the roots are of little use. But for hundreds of years the Chinese have thought that ginseng roots would cure most kinds of sickness. There are Chinese stories which tell how wild animals protect this wonderful plant. There are other Chinese stories which tell that the plant travels underground to escape its enemies.

Probably the shape of the ginseng roots gave the Chinese the idea that they would be good medicine. Notice that the root in the picture is shaped somewhat like a man. "Ginseng" means "likeness of men."



Ginseng

GIOTTO (1276?–1337) In Italy, not far from Florence, a barefoot boy named Giotto tended sheep and drew pictures in the sand with his toes. Now and then with a sharp pebble he would scratch a picture on a flat rock. Purple mountains rose in the distance. It was very quiet in the fields except for the tinkling bells on the sheep.

One day while Giotto was drawing a picture of a sheep, a man came riding by. A glance at the picture told the rider that the boy was gifted. He jumped off his horse and shouted, "You must come to Florence and help me in my bottega." A bottega was a workshop. The man was the greatest Italian artist of the time, Cimabue.

Giotto was only ten years old then, but his parents let him go to Florence. He was called an apprentice. Cimabue had several other apprentices. His apprentices all lived with him. They worked hard in the workshop during the daytime. But they had fun together in the evenings.

Giotto liked Florence. The little red carts drawn by donkeys made pleasant rattling noises on the stony streets. There were many wonderful statues, paintings, and buildings to see. The rich people of the city wore beautiful velvet clothes.

Day after day Giotto washed brushes, ground colors, and practiced drawing and painting. At that time oil painting had not yet been invented. Cimabue and many other painters of the time were fresco painters. Fresco is watercolor painting done on wet plaster.

When Giotto was still a boy, Cimabue said to him, "You are now a greater artist than I am." He let Giotto draw the sheep whenever he needed sheep in his pictures. Giotto could draw sheep better than anyone else in Florence because he had studied them so much as a child.

When Giotto was a young man, he set up a workshop of his own. In time he was called to Rome to make a mosaic showing Jesus walking on the Sea of Galilee. A mosaic is a picture made of many tiny pieces of glass or stone. In Rome Giotto learned much about lifelike painting that helped him to be a great artist.

Giotto became an architect as well as a painter. His best-known work as an architect is a famous bell tower, now called Giotto's Tower, in Florence.

Giotto's greatest paintings are the frescoes in a small church in Padua. There are 38 frescoes in the one little church. It took him over two years to paint them.

The frescoes in Padua tell the story of the Mother of Jesus and of Jesus himself. Giotto has been called the greatest storytelling artist. The people in his pictures look almost as if they were cut out of stone, they are so rounded. Each picture is much like a stage on which people are acting.

With their hands they show joy, pain, longing, and deep sorrow.

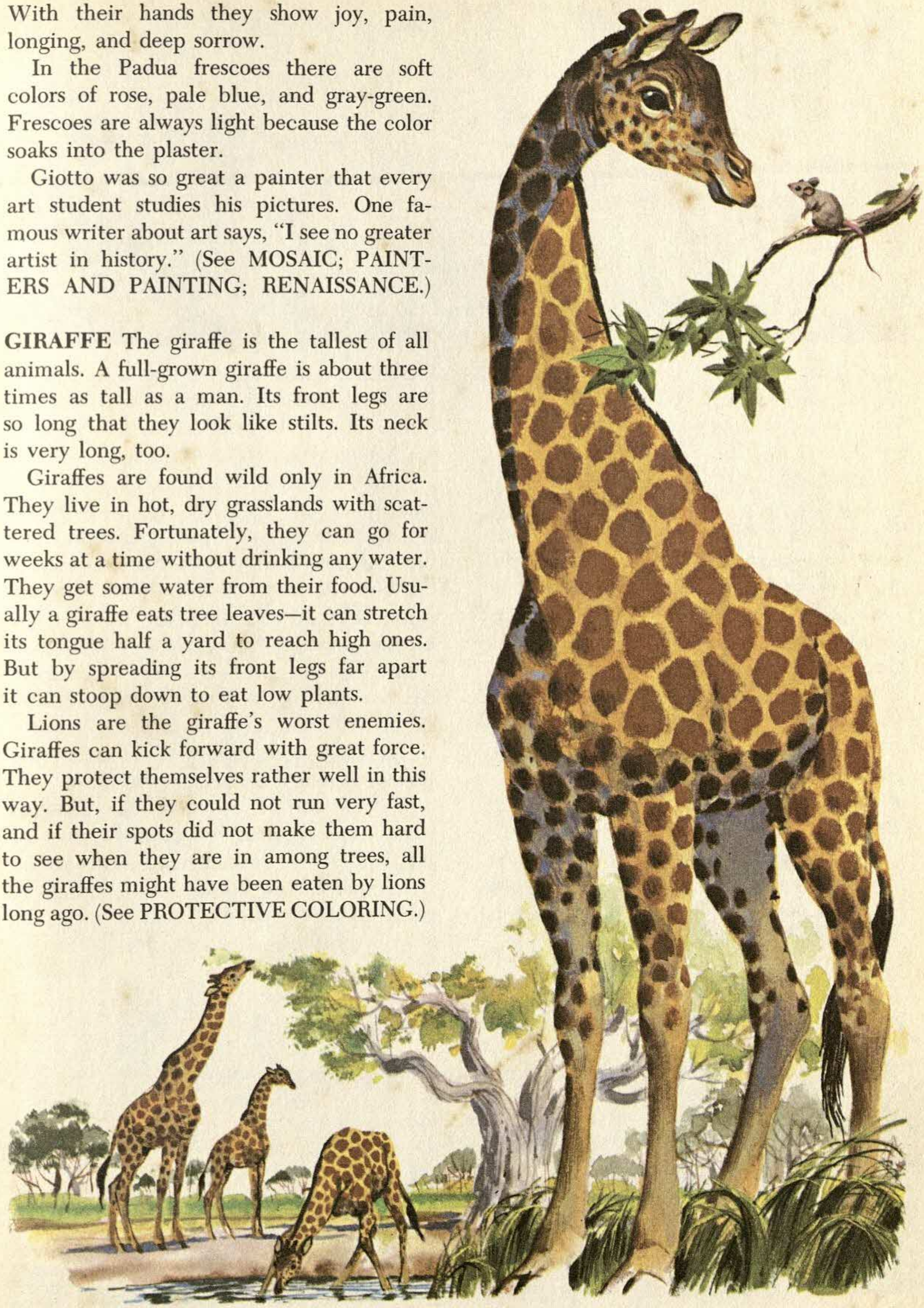
In the Padua frescoes there are soft colors of rose, pale blue, and gray-green. Frescoes are always light because the color soaks into the plaster.

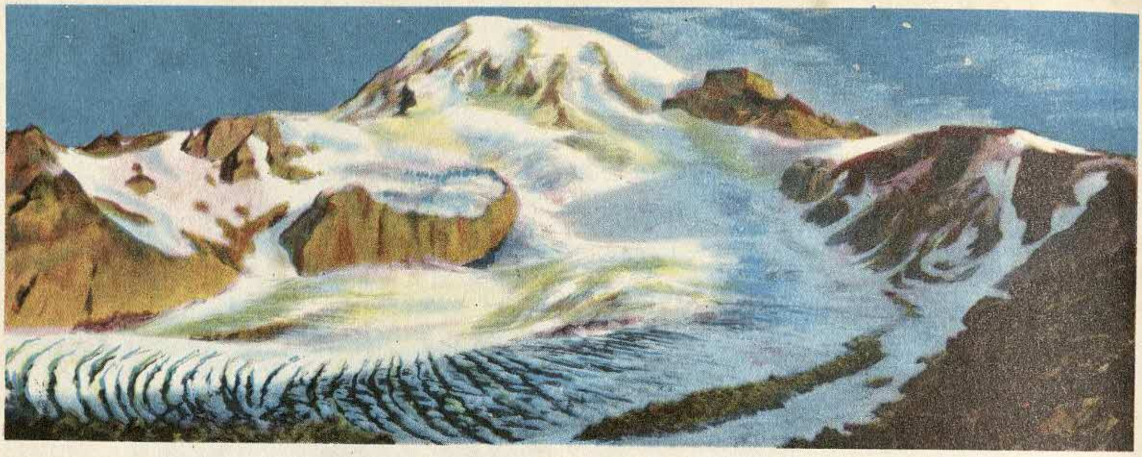
Giotto was so great a painter that every art student studies his pictures. One famous writer about art says, "I see no greater artist in history." (See MOSAIC; PAINTERS AND PAINTING; RENAISSANCE.)

GIRAFFE The giraffe is the tallest of all animals. A full-grown giraffe is about three times as tall as a man. Its front legs are so long that they look like stilts. Its neck is very long, too.

Giraffes are found wild only in Africa. They live in hot, dry grasslands with scattered trees. Fortunately, they can go for weeks at a time without drinking any water. They get some water from their food. Usually a giraffe eats tree leaves—it can stretch its tongue half a yard to reach high ones. But by spreading its front legs far apart it can stoop down to eat low plants.

Lions are the giraffe's worst enemies. Giraffes can kick forward with great force. They protect themselves rather well in this way. But, if they could not run very fast, and if their spots did not make them hard to see when they are in among trees, all the giraffes might have been eaten by lions long ago. (See PROTECTIVE COLORING.)





GLACIER A glacier is a river or great moving sheet of ice. Rivers of ice are always in valleys. They are often called valley glaciers. Great moving sheets of ice are often called ice caps.

A glacier begins as a snowfield. Little by little the snow becomes solid ice. The ice grows thicker and begins to move. The snowfield has become a glacier.

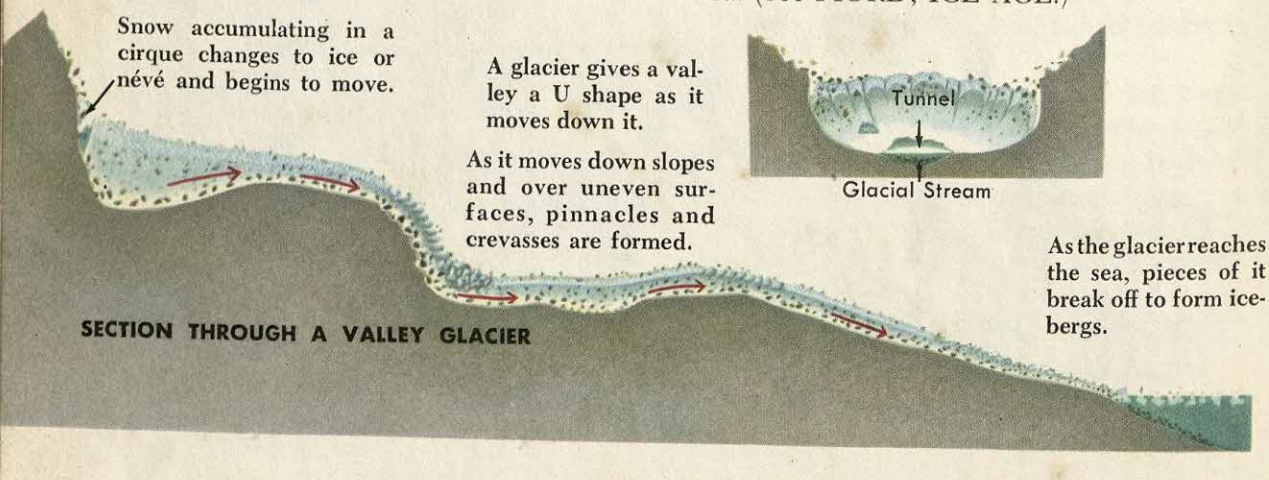
A valley glacier moves down its valley, perhaps a foot a day, perhaps more than a hundred. All valley glaciers move, but some of them do not seem to be doing so. A glacier seems to be standing still if the ice at the end melts as fast as more ice is pushed down. An ice cap moves outward in all directions. But it may move faster at some places than at others.

As glaciers move, great cracks appear in them. These cracks are called crevasses. Crevasses make the exploring of glaciers exciting and dangerous.

Glaciers grind up rocks as they move. They push and carry along great amounts of rock rubbish. Its load of rock rubbish is left behind when a glacier melts.

Valley glaciers are common in the Alps and Himalayas. They are common, too, in Norway, Alaska, and western Canada. Glacier National Park, which has several glaciers, is in northwestern United States. Antarctica and Greenland are almost completely covered with big sheets of ice. These ice caps are both more than a mile deep in places. In 1968 scientists drilled a hole 7,100 feet deep through the Antarctic ice cap. The ice at the bottom was thousands and thousands of years old!

The climate of the world has changed many times. If it should get so warm that all the glaciers melted, the oceans would rise 200 feet. New York, London, and every other great coastal city would be under the sea. (See FIORD; ICE AGE.)



Snow accumulating in a cirque changes to ice or névé and begins to move.

A glacier gives a valley a U shape as it moves down it.

As it moves down slopes and over uneven surfaces, pinnacles and crevasses are formed.

As the glacier reaches the sea, pieces of it break off to form icebergs.

SECTION THROUGH A VALLEY GLACIER

Blowing a Glass Flask

Cutting Off the Blown Flask

GLASS Imagining that a substance suddenly disappears helps us see how important it is. Suppose glass should suddenly disappear. The windows in our buildings would be just openings. There would be no windshields or window glass in our cars. Walls made of glass bricks would be gone. People would have no eyeglasses or opera glasses or binoculars. Microscopes, telescopes, and cameras would be useless without their glass lenses and mirrors.

Scientists would have no glassware to use in experiments. Doctors would have no fever thermometers. There would be no glass tumblers or plates or cups and saucers. No greenhouses or show windows or showcases. No electric lamp bulbs or radio and television tubes. No bottles on our medicine shelves. No glass threads to weave into cloth. No glass wool in walls to shut heat in or out. No pretty vases or other glass ornaments. The world would be different indeed without glass. Even the laser, one of the newest tools scientists have devised, uses glass.

The very first glass was made by nature in volcanoes. Obsidian is volcanic glass. Ancient man fashioned obsidian into spearheads and arrow tips.

Just when people learned to make glass no one knows. A story nearly 2,000 years old tells that some Phoenician merchants were cooking supper one day on a sandy riverbank. To hold their kettle up above the fire they used two chunks of the material with which their boat was loaded. This material was natron, or soda ash. After the fire was out, the merchants found that some of the sand that had been heated under the fire had been made into glass.

Probably this story is not true. But it may help us remember that glass is made mostly of sand and that soda ash or some similar chemical must be mixed with the sand to make it melt when it is heated.

Making glass is a little like making candy. The sand is the sugar. The chemical that makes the sand melt takes the place of the water or milk that dissolves the sugar. Different materials are added to make different kinds of glass, just as flavorings are added to make different kinds of candy. The mixture is cooked until it is done. Then it is made into any shape wanted.

There is one big difference between making glass and making candy. For glass the mixture must be heated extremely hot in big furnaces. It must be heated in clay pots; iron ones would not stand the heat.

There are many, many recipes for candy. Perhaps there are even more for glass. At least there are over 20,000.

Making glass sounds simpler than it is. One trick in making good glass is to start with very pure materials. Even tiny bits of some impurity may spoil a batch of glass. A trace of iron oxide, for instance, will give glass an ugly greenish color. Another trick in glassmaking is to cool the finished glass properly. A whole year was needed to cool the glass for the mirror of the giant Palomar telescope.

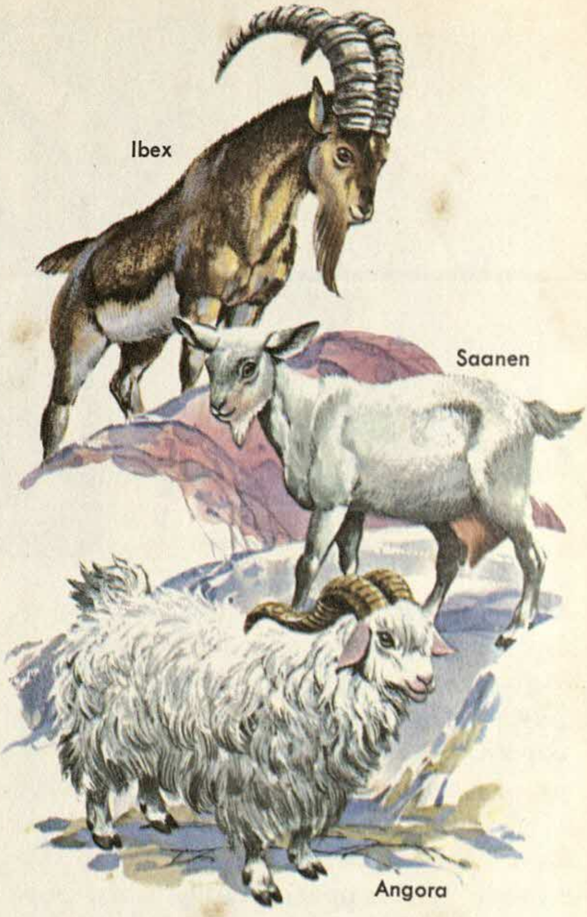
There has been some man-made glass for several thousand years. The ancient Egyptians made glass beads and put thin layers of glass, or glaze, over clay figures. The Romans learned how to lift a lump of soft glass on a hollow iron rod and blow it into vases and bottles.

During the Middle Ages Venice was the leading glassmaking city of the world. Venetian glassmakers blew fairylike goblets, vases, and other wares. They knew how to put wonderful colors in their glass—rich blues, greens, reds, and purples.

There were beautiful glass vases before there was any window glass. It was not at all easy to take a bubble of glass and flatten it out into a sheet. But ways were found of doing so. Glass windows were then possible—not at first for homes, because of the cost, but for churches. In the Middle Ages stained-glass windows were made of small pieces of beautifully colored glass held together by strips of lead.

For centuries all glassware was scarce and expensive. For every piece of glass had to be made by hand. It took a long time to make a good piece of glass and a very long time to train a good glassblower.

But at last machines came into the picture. In 1828 an American, Deming Jarves, was given a patent on a way of pressing glass into shape in a mold instead of blowing it. Another American, Michael J. Owens, invented a bottlemaking machine in 1903. Machines were invented for making smooth, clear sheets of glass. Scientists still blow glass into specially shaped pieces of apparatus that they need. But for the most part only the most beautiful and expensive glass is now made by hand.



Glass is fireproof. It is waterproof. Most acids cannot eat into it. Rats, mice, and insects cannot destroy it. It can be very beautiful. But it breaks!

Glassmakers have made great strides in overcoming this big objection to glass. They have added boron to glass to keep it from breaking easily when it is heated. Such glass can be used for ovenware. They have made shatterproof glass for cars by sandwiching a piece of plastic in between two layers of glass. They have made glass for show windows that, if it breaks, will break into such tiny powdery pieces that no passerby will be hurt. They have even been able to make very expensive glass that is almost unbreakable. With glass needed for so many things, we can be sure that many people are at work trying to make it better and better. (See BUILDING MATERIALS; LENS; MICROSCOPE; MIRROR; SAND; STAINED GLASS; TELESCOPE.)

GOATS Male goats have beards. In other ways goats look a great deal like sheep. But they are not such well-behaved animals. They are hard to keep in a field.

Many goats are raised in mountain lands where the ground is rocky and the pasture is poor. They will even thrive in cities with little to eat besides waste vegetables and a few scrubby bushes. Goats seem to like to go exploring. They explore gardens, piles of garbage, and rubbish heaps. But they do not, as some people think, eat tin cans. In northern Africa the goats even climb low-branching trees to get food.

In many countries goat's milk and cheese from it are very important foods. The goats may be driven from door to door and milked for each customer. Goats are also raised for meat and for their hair. The hair is called mohair.

There are many kinds of goats. The picture shows two kinds people raise. The long-haired Angora is raised for its hair. The Saanen is a milk goat. Ibexes are wild goats. They live in many mountain regions, among them the high Himalayas. The Rocky Mountain goat is not a true goat. It is a closer relative of the chamois of Europe. (See CHEESE; DOMESTICATED ANIMALS; HOOFED ANIMALS; MILK.)

GOATSUCKERS The whippoorwill belongs to a bird family with the odd name of goatsuckers. The chuck-will's-widow, the poorwill, and the nighthawk are other goatsuckers found in the United States. The family got its name because people long ago thought that the nightjar was able to milk goats. The nightjar is a goatsucker common in Europe, where many goats are raised for milk. Of course, neither the nightjar nor any other bird can milk goats. It is hard to see how the idea began.

It is easier to see how the different birds in the family got their names. The whippoorwill, poorwill, and chuck-will's-widow got theirs from their calls. In many places the call of one or another of these birds is a common night sound. A whippoorwill may utter its call hundreds of times without stopping. The nighthawk flies about at dusk and looks a little like a hawk. The "jar" in the nightjar's name means "harsh sound." Like other goatsuckers, the nightjar is a night bird.

Many people have seen nighthawks but have never seen any of the other goatsuckers. The other birds in the family are much more shy than nighthawks. Nighthawks often nest in cities and are seen swooping about over city buildings. The other goatsuckers are country birds.

Goatsuckers do not build nests. They usually lay their eggs on the bare ground or on beds of leaves. Nighthawks often lay their eggs on roofs that are covered with gravel. All the goatsuckers have coloring that makes them hard to see as they sit on their eggs or rest on a tree branch or the ground.

These birds have short bills and wide mouths with whiskers around them. Their big mouths are well fitted for catching insects in the air. The birds simply open their mouths and fly fast. All the goatsuckers are friends of ours because they catch great numbers of harmful insects.

Most goatsuckers live through the time when there are no flying insects about by going south in the fall. Many poorwills, however, spend winter in a way no other birds are known to. They hibernate!

Whippoorwill

Gold Nugget

Gold Flecks in Quartz

Ancient Gold Mask from Mexico

GOLD Wars have been fought for gold. Explorers have braved many dangers to find it. The discovery of gold has brought a rush of settlers to many places. In the Middle Ages alchemists spent their lives trying to change cheaper metals into gold.

Gold has been known since the beginning of history. Surprisingly, it was known long before the common metal aluminum. Aluminum was hard to discover because it is always joined with other materials. Gold often is found free.

Gold was used for ornaments long before it was used as money. It was much wanted for its beauty. Ancient gold ornaments have been found in many places.

As money, gold served well. It was scarce, but not too scarce. It was lasting. And it could easily be shaped into coins. Much money today is paper money, but governments still have stores of gold.

Since gold does not spoil, it can be reworked again and again. The gold in a ring bought today may once have been part of an Inca ornament. It may have been a coin in a pirate's treasure. Of course, it may have been mined only a few months ago.

The first gold was found on or near the surface of the ground. The earliest way of mining it was to dig up gravel that had gold in it and wash away everything except the gold. Gold can be mined in this way because it is very heavy. Chunks of gold are called nuggets. Most of them are tiny, but some are quite large. The "Welcome Stranger Nuggett" found in Australia was so big that it sold for $52,500.

Today most gold is mined deep underground. The gold is found in veins in the solid rock. Some mines are two miles deep.

Gold in jewelry and ornaments is usually mixed with other metals to make it harder. The finest gold jewelry is marked 18K (18 carat). It has 18 parts of gold to 6 parts of another metal. In 14K gold there are 14 parts of gold to 10 parts of another metal. Pure gold would be 24K.

Long ago people learned to hammer gold into very thin sheets, or gold leaf. Some is so thin that 350,000 sheets make a pile only an inch high. Gold leaf is used to make letters on books and signs and to decorate china, furniture, and even buildings.

Not all gold goes into money and decorations. Much gold, for instance, goes into fillings for teeth and into electrical connections. And, as a new space age use, a very thin layer of gold plated on their visors protects astronaut walkers in space from both ultraviolet and infrared rays.

Although gold mining began thousands of years ago, all the gold that has ever been mined could be stored easily on the first floor of the White House. The amount now being added each year to the world's supply could be put into a room 15 feet by 15 feet by 12 feet with room to spare.

Today South Africa is far ahead of other countries in the amount of gold mined. The U.S.S.R., Canada, the U.S.A., and Australia are other important gold producers. (See ALCHEMY; ELEMENTS; METALS.)

Gold Crystal

Gold Ore

Golden Gate Bridge

GOLDEN GATE A short and narrow strip of sea leads from the Pacific Ocean into San Francisco Bay. This strip of sea is called the Golden Gate. The general name for such a strip of water is "strait." The Golden Gate, then, is a strait.

The famous explorer Sir Francis Drake sighted this strait on his trip around the world in the late 1500's. Some people think Drake gave the strait its name. But John C. Frémont, an American explorer, claimed that he named the Golden Gate.

The name had real meaning during the gold rush to California in 1849. Many people sailed through it on their way to hunt for gold. Everyone who has seen the waters of the Golden Gate glitter in the sunset agrees that the name is still a good one.

San Francisco is on one side of the Golden Gate. One of the world's greatest bridges, the Golden Gate Bridge, stretches more than a mile from San Francisco across the strait. (See BRIDGES; CALIFORNIA; SAN FRANCISCO; STRAIT.)

GOLDENROD In many parts of America goldenrod in bloom along the roadsides means that fall is on its way. Goldenrod gets its name from the bright yellow color of its flowers.

Goldenrod belongs to the composite family, the biggest of all the families of flowering plants. Like all other plants in this big family, its flowers are made up of a number of tiny flowerets.

There are many different kinds of goldenrod—more than 100 in all. Some have rough stems, some have smooth stems, and some have stems covered with hair. The leaves of the goldenrods differ, too. Some are narrow, some wide. Some have toothed edges, while others have smooth edges.

Goldenrod grows in many places. One kind, called seaside goldenrod, grows in salt marshes by the sea. Alpine goldenrod grows on mountaintops. The large-leafed goldenrod grows in damp woods.

Unfortunately, many people believe that goldenrod gives them hay fever. Actually goldenrod is seldom to blame. Hay fever is much more often caused by pollen from ragweed, which blooms at the same time as goldenrod.

GOLDENRODS

4993

STATE INSTI... West Bengal.
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GOLDFISH All the fish in the picture are goldfish, although they do not look very much alike. All these kinds, and many more, too, have come from the wild goldfish that has lived for centuries in the streams of China and Japan.

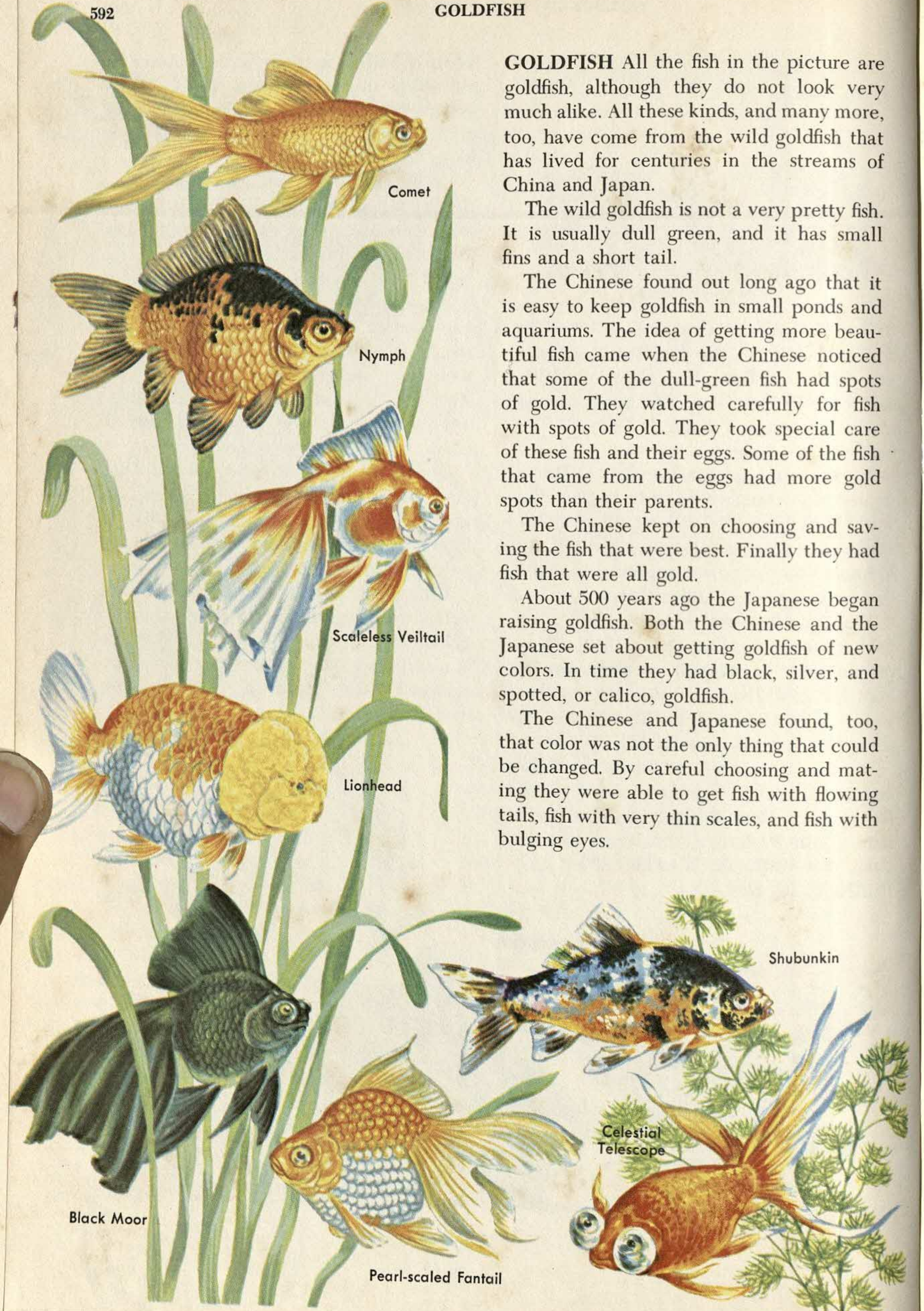
The wild goldfish is not a very pretty fish. It is usually dull green, and it has small fins and a short tail.

The Chinese found out long ago that it is easy to keep goldfish in small ponds and aquariums. The idea of getting more beautiful fish came when the Chinese noticed that some of the dull-green fish had spots of gold. They watched carefully for fish with spots of gold. They took special care of these fish and their eggs. Some of the fish that came from the eggs had more gold spots than their parents.

The Chinese kept on choosing and saving the fish that were best. Finally they had fish that were all gold.

About 500 years ago the Japanese began raising goldfish. Both the Chinese and the Japanese set about getting goldfish of new colors. In time they had black, silver, and spotted, or calico, goldfish.

The Chinese and Japanese found, too, that color was not the only thing that could be changed. By careful choosing and mating they were able to get fish with flowing tails, fish with very thin scales, and fish with bulging eyes.



Now goldfish are raised in many parts of the world. Millions are sold each year for ponds and aquariums. And goldfish breeders are still working to get new kinds.

Like any other pet, a goldfish must have proper care and the right kind of place to live. A two-inch fish needs at least two gallons of water. The water must have oxygen in it or the fish cannot breathe. Oxygen gets into the water of an aquarium from the air that touches the surface.

Plants in an aquarium help furnish oxygen, too. Green plants throw oxygen away during daylight hours when they are making food for themselves. At the same time they use up carbon dioxide, which the fish breathe out. Snails help keep an aquarium clean. The water in an aquarium should not have to be changed often.

Food made of such things as dried insects and tiny crustaceans can be bought for goldfish. Goldfish should not be overfed. They should never be given more food at one time than they can eat up in 15 minutes. And they should not be fed more than once a day. (See AQUARIUM; PETS.)

GOODYEAR, CHARLES (1800–1860) Millions of people around the world today ride about on rubber tires. They all owe a debt to Charles Goodyear.

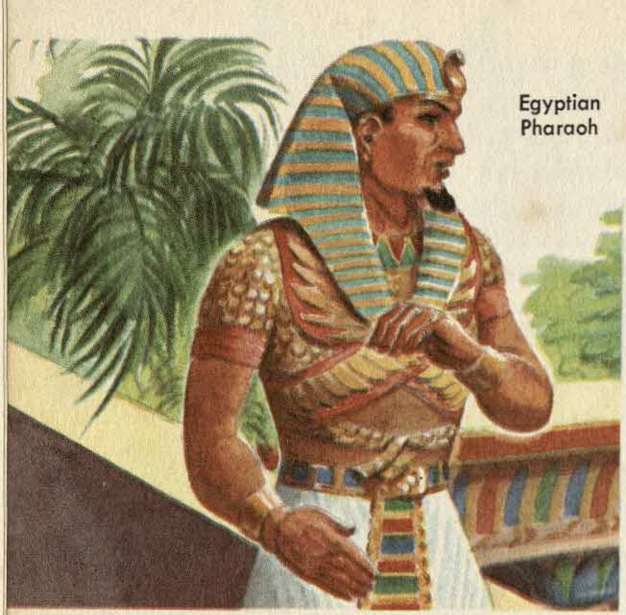
Rubber was known long before the time of Goodyear, but it had serious drawbacks. In cold weather it would become hard and crack. In warm weather it would get sticky and give off a bad odor.

Many people tried to find some way to make rubber into a more satisfactory material. Charles Goodyear was one of them. He carried on hundreds of experiments. He mixed many other substances with rubber to see what effect they would have.

One day in 1839, while he was working on one of his experiments, he accidentally dropped a piece of rubber mixed with sulfur on a hot stove. The rubber and sulfur mixture charred but did not burn. When Goodyear tried out this rubber, he found that it was better than any other rubber he had seen. It did not get sticky and give off a bad odor when it was warmed. Cold did not make it crack. The sulfur and the heat together had changed the rubber in some way.

Goodyear's way of preparing rubber is called vulcanization. The word came from "Vulcan," the name of the Roman god of fire.

Goodyear was born in New Haven, Conn. His father was an inventor of farm machinery. Goodyear did not make a fortune from his discovery about rubber. In fact, at one point in his life he was put into debtor's prison. He was discouraged and deeply in debt when he died. Goodyear had no way of guessing that automobiles, trucks, buses, tractors, and airplanes would be invented and that rubber would be used in tires for them by the billions of pounds.



Egyptian Pharaoh

GOVERNMENT We all live under some kind of government. It may be a government in which the people choose their own rulers. On the other hand, the top ruler may be a king or a queen who inherited the right to rule. The ruler may be a dictator who seized the powers of a ruler. In some of the out-of-the-way corners of the earth the rulers are tribal chieftains.

A government may be good or it may be bad. Some people believe that all government is bad. They think that there should be no government. These people are called anarchists. But there are not many anarchists. Government came about because people wanted things they could not get for themselves. Doing without government would mean that everyone would be on his own. With people crowded together as they are today, no sensible person believes in anarchy.

Government began without any deliberate planning. Our early ancestors did not come together and say, "Now we have to have some kind of government. What kind shall we have?" Instead, it developed gradually as different things were needed.

Even in very early times groups of people living together had government of a simple kind. One early kind of group is called a patriarchal clan. This kind of group appeared when people became herders and farmers instead of hunters. "Patriarch" comes from the word for father. Sons, when they married, did not leave their family group. Their sons, in turn, stayed on. In time a rather big group, or clan, grew up. The father of the whole clan—the patriarch—was looked up to as the wisest member of the group. His word came to be law.

Some of the early bands of people became larger groups, or tribes. Groups often grew by conquering other groups. In the bigger groups some kind of rule was needed even more than in the smaller groups. Disputes between members of a tribe had to be settled, and the tribe had to be led in warfare against other tribes. In tribes a chieftain took the place of the patriarch. Since his most important duty was to protect his people, he was usually a good fighter. In return for leading them in battle his people were willing to do as he said. When the chieftain of a tribe died, his son might be accepted as ruler.

In the early days of tribes the chieftain was the ruler of a certain group of people. He was not the ruler of a certain part of the earth. Usually the tribes moved about from place to place. But in time tribes settled in different regions. Then rulers were lords of the land as well as lords of the people. There came to be countries.

The story of countries is a long story of experiments with different kinds of government. In the great days of ancient Egypt the ruler was called a pharaoh. The pharaoh was rich and powerful. His people had little freedom. Their work was planned for them by the government. They had almost no chance to think for themselves. The pharaoh himself did not do all the work of ruling. He had soldiers, tax collectors, judges, priests, and scribes to help him.

The great power of the pharaoh is easily explained. With huge waterworks he controlled the water of the Nile. The very life of the people depended on this water. Besides, the Egyptians thought of him as a god. In spite of his great power over his people, the pharaoh was not really free either. Customs made it impossible for him to do exactly as he pleased.

None of us would like to live under a government like ancient Egypt's. But one of the ideas of the Egyptians and also of other great peoples of ancient times is important in the story of government. They had the idea of empire—of building many weak groups into one strong group.

Very different from the government of ancient Egypt was that of Athens in the golden age of Greece. Athens, after trying other kinds of government, had become a democracy. "Democracy" comes from two Greek words meaning "people" and "rule." The people of Athens had worked out a way of ruling themselves.

Although the government of Athens was a democracy, not everyone could have a share in it. Women could not vote. Slaves could not. Neither could men who had not been born in Athens. But every *citizen* could vote. Every citizen could hold office.

Ancient Rome, like Athens, tried out several kinds of government. At the time of Rome's greatest power it was ruled by an emperor. His chief helpers were the leaders of his armies.

Rome conquered one land after another. Great roads were built to tie the empire together. There was one set of laws for the whole empire. The same weights and measures were used everywhere in the empire. So were the same coins. So was the same language. Some of the Roman emperors were weak. Others were cruel. But the idea of "the same for everyone" was an important idea in government.

The climb from the first simple governments to the governments of today has not been a steady upward climb. In fact, there have been many times of backsliding.

Ten centuries ago in Europe there was almost no government. A person's life was often in danger. Gradually feudalism grew up. This was the time of knights and lords and ladies. The lords lived in castles; they owned much land. Each lord ruled and protected the people on his land. In turn they served him. Feudalism was a real step upward from the conditions that went immediately before it.

The story of government in the past 1,000 years is the story of many struggles in many places. Strong nations have grown up. In many the people have fought for a chance to help rule themselves. They have fought for constitutions—statements of just what their rights are and how the work of the government is to be done. There have been struggles to separate government and religion. Sometimes people have given up some of their freedom for protection.

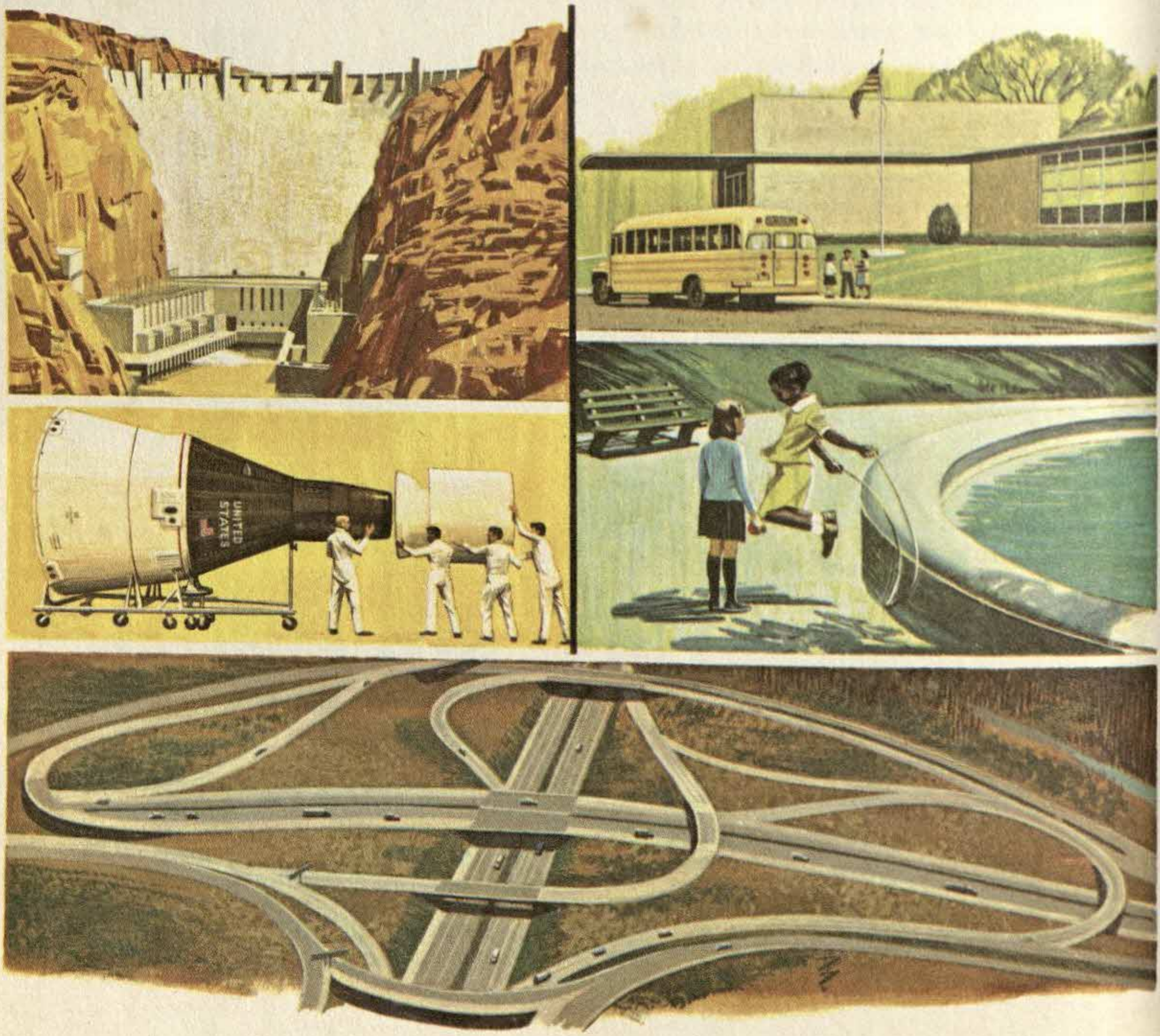
Even today the peoples of the world do not all agree as to what kind of government is best. But whatever ideas of government

they have, people want more from their governments than ever before.

Many people get services from more than one government. They are, we say, under different layers of government. A Chicagoan, for instance, is under the governments of the city of Chicago, Cook County, the state of Illinois, and the United States. Village, city, and county governments are called local governments. The government of the United States is called the national, or federal, government.

Among the many responsibilities of the federal government of the United States are maintaining the armed forces, issuing money, operating the Post Office and Weather Bureau, building dams for power and irrigation, carrying on a space program, and handling international affairs. Providing care for the blind and mentally ill, and examining would-be teachers, doctors, and lawyers are among the special tasks of state governments. People depend on local governments for such things as police protection, water supply, sewage disposal, garbage collection, street cleaning and lighting, and public libraries and playgrounds. Federal, state, and local governments share some responsibilities. Education, major highways, welfare, and justice are a few.

It goes without saying that, as people ask more and more of their governments, more and more workers are needed to give those services. Millions and millions of people today are in government work. (See COMMUNISM; DEMOCRACY; DICTATORS; LAWS; MONARCHY; SOCIALISM; TAXES; U.S. GOVERNMENT.)



GRAFTING Imagine an apple tree with bright-red Jonathan apples on one limb, Golden Delicious apples on another, and dark-red Winesaps on a third. It is possible to have just such a tree. The process called grafting makes it possible.

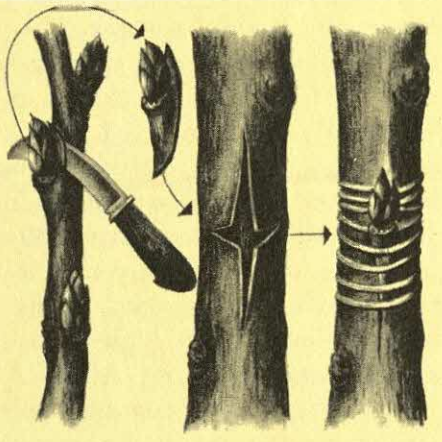
Grafting means joining parts of different plants together so that they grow to be one plant. The top of a young crab apple tree, for example, may be cut off and the twig of another apple tree put in its place. The inner layer of the bark of a woody plant is called the cambium. It is made up of live and growing cells. In grafting, the cambium layers must come together.

There are many ways of grafting. The pictures show two. The joining is protected by a bandage or a coating of wax.

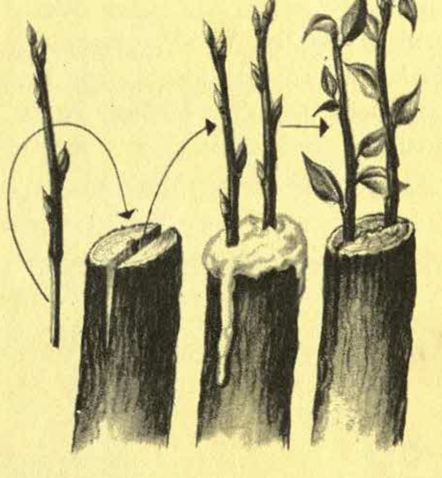
Fruit trees grown from seeds are not likely to bear fruit just like the fruit that the seeds came from. For the little plant in the seed usually has two different trees as parents. If so, it is sure not to grow into a tree exactly like either parent. The only possible way of getting a new Golden Delicious apple tree is to graft a twig from a Golden Delicious tree onto the stem and roots of some other kind of tree. It may be another apple tree, or a quince tree.

By grafting to roots of low-growing varieties we can get dwarf fruit trees. A dwarf tree can be cared for more easily than a tall one, and its fruit is easier to pick. Picking the apples from a full-size McIntosh apple tree calls for a ladder with almost 50 rungs! No wonder growers are turning more and more to dwarf trees for orchard planting.

Fruit trees are not the only plants that are grafted. Grapevines, rosebushes, and lilac bushes are a few of the others that are. But only plants with woody stems can be grafted, and the parts must come from plants that are close relatives. It is fun to think of grafting a rose twig on a walnut tree and getting a rosebush 60 feet tall. But roses and walnuts are not close enough relatives to make such a rosebush possible.



Bud Grafting



Cleft Grafting

Sometimes the top of a grafted plant may be broken off. Then the stem may send out branches and grow into its kind of plant. One man had a funny experience. He grafted twigs of dwarf, or umbrella, catalpa trees to the trunks of two young hardy catalpas. Then he planted the little trees side by side. They grew into pretty umbrella-shaped trees about ten feet tall. A windstorm broke off the top of one tree. Soon the trunk of the damaged tree began to send out branches. It developed into a hardy catalpa nearly 30 feet tall. It and its former twin were a strange pair. (See FRUITS; SEEDS; TREES.)

GRAND CANYON In America there is a great deal of beautiful scenery. The most wonderful sight of all, many people think, is the Grand Canyon. More than a million people visit it every year.

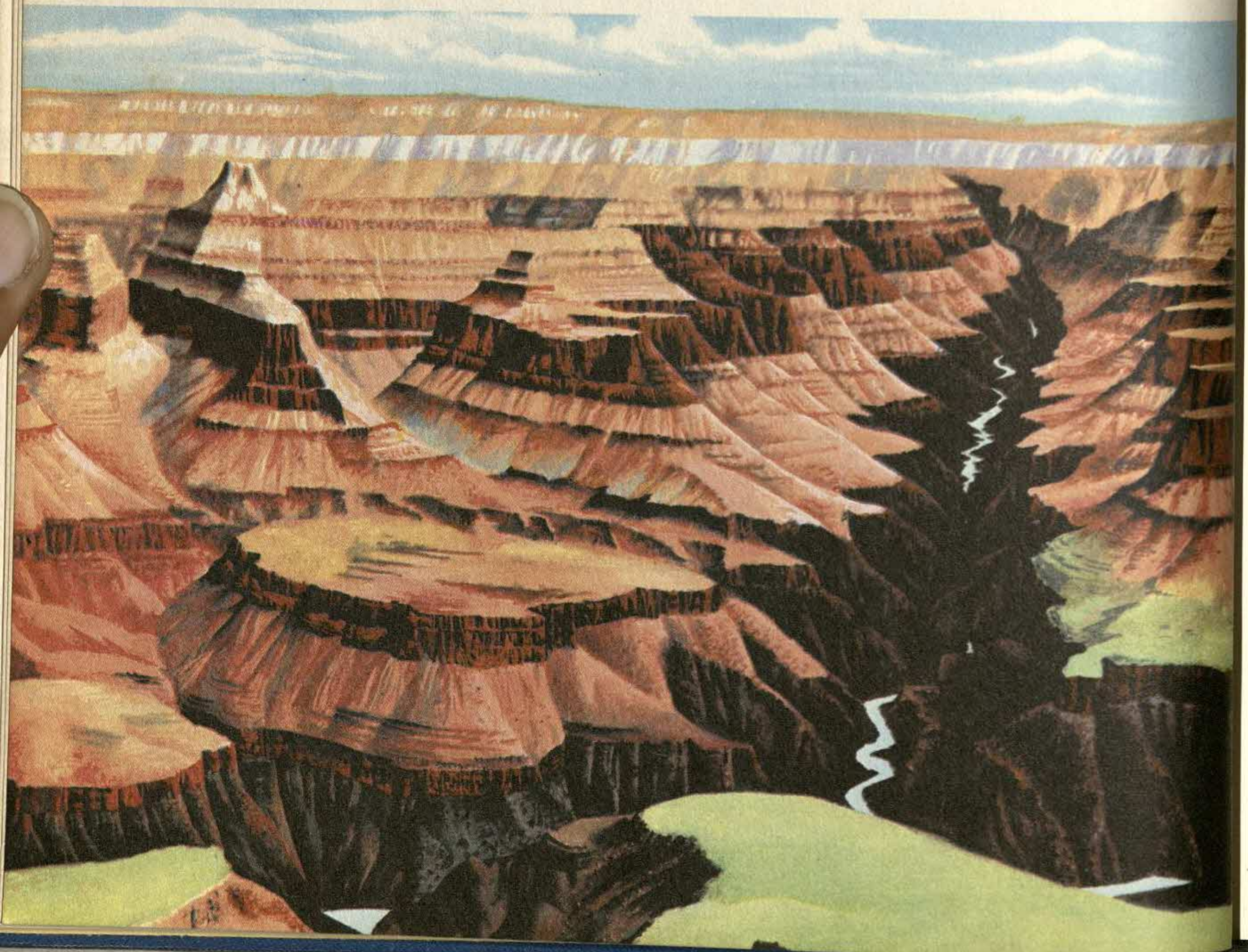
This canyon is in northern Arizona. It is a part of the valley of the Colorado River. But what a valley! The canyon is 280 miles long, from 4 to 18 miles wide, and, in places, more than a mile deep. Rising from its floor are mountains higher than the highest mountains in the Appalachians. But their peaks do not reach up as high as the rim of the canyon. In the mountains, as well as in the canyon walls, the layers of rock are beautifully colored.

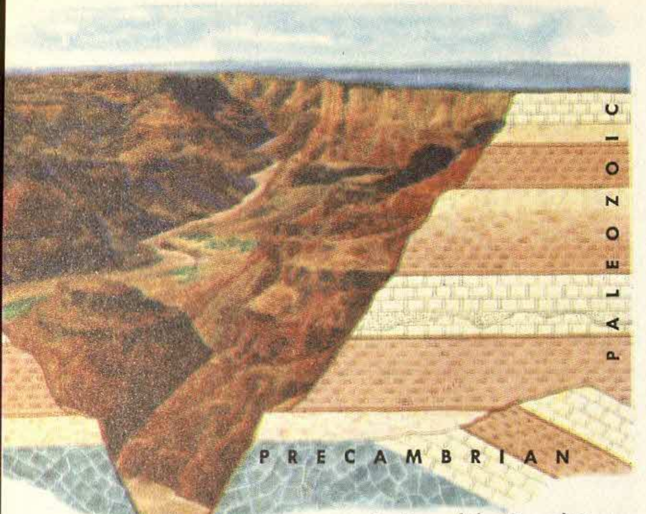
Trails lead down the steep sides of the canyon to the bottom. The story of a trip to the bottom of the canyon might be called "Climbing Down 600 Million Years." For the rocks at the bottom of the canyon walls are at least 600 million years old.

Most of the layers of rock in the walls of the canyon are sandstone and limestone and shale. These rocks are water-made rocks. They tell that for millions of years this part of the world was under the sea.

At the very bottom of the canyon the rock is granite. Granite is formed from hot, liquid rock like the lava that pours out of volcanoes. But it is formed deep underground. The granite at the bottom of the canyon was formed long before there were any people on earth, long before the days of the dinosaurs, even before the time when trilobites were the earth's leading animals. The story the canyon tells is a long chapter in the story of the earth.

A trip to the bottom of the canyon might also be called "Four Climates in a Mile's Journey." For traveling down into the canyon is like traveling from Canada to Mexico. Near the top one finds the blue spruces and aspens of Canada. Lower there are the





Section of the Grand Canyon

yellow pines of the Rockies. Still lower one finds piñon pines like those of the southwest desert. At the bottom the plants are plants common in Mexico.

How did the Colorado River find its way into this great gash in the earth? The answer is that the river itself carved the valley. It had the help of many small but swift streams running into it. Nowhere else in the world is it so easy to see how running water can change the face of the earth. (See ARIZONA; EROSION; NATIONAL PARKS.)

GRAPES Vineyards, fields where grapes are grown, have been common for many thousands of years. The Bible mentions vineyards. Probably the grape was one of the very first fruits men learned to raise.

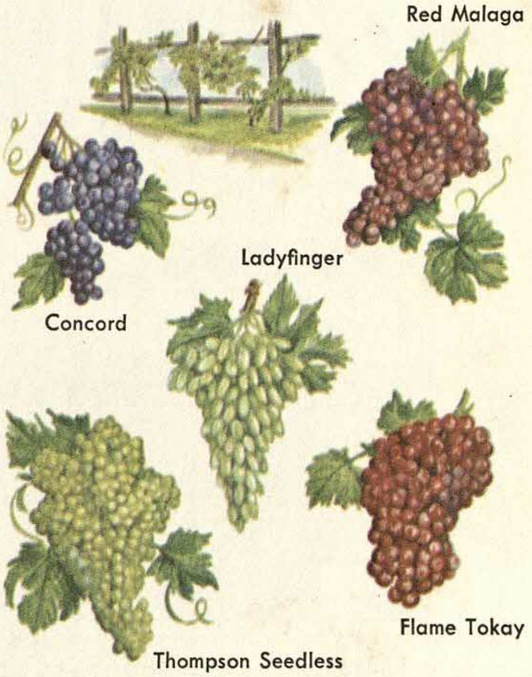
Today there are more than 8,000 kinds of grapes. They have all come either from the wild grapes of the Near East or from those of North America. The picture shows a few of the many kinds.

Grapes grow on vines. The vines can be cut back till they are like bushes. But in most vineyards the vines are given stakes or trellises to grow on. Even then they have to be trimmed every year. Trimming makes them bear better.

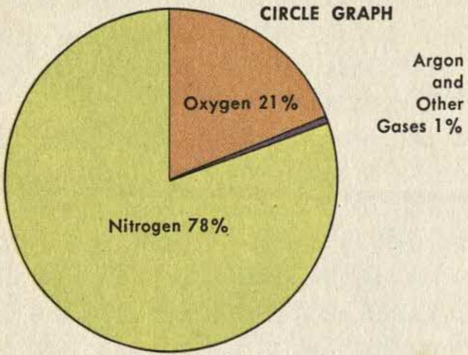
Some grapes are raised for raisins. Raisins are simply dried grapes. Some grapes are raised to be eaten in hand. Some are raised to be made into grape juice or jelly or jam. And a very great many are raised for wine. Making wine from grapes goes back to prehistoric times.

In the grape-growing region near the Great Lakes many of the grapes grown are Concords. In Concord, Mass., there is a monument to the first Concord grapevine. This vine can be traced back to a seed that was planted by accident over 125 years ago. It probably was a seed of the wild fox grape. All of today's thousands and thousands of Concord grapevines have come from the first Concord vine.

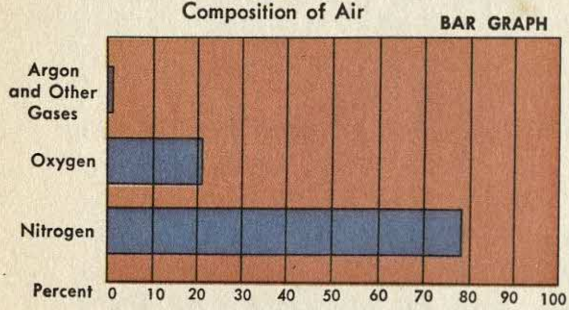
One of the greatest enemies of vineyards is a plant louse. Early settlers in America brought grapevines with them from Europe, but this insect soon killed the vines. The pest was carried back across the ocean. Many vineyards in France were almost ruined. Then a way was found of saving France's vineyards. Grapes developed from the wild grapes of America are resistant to injury from this plant louse. European varieties grafted onto roots of American grapes became resistant to it, too. (See FRUITS; GRAFTING; VINES.)



TYPES OF GRAPHS



Composition of Air



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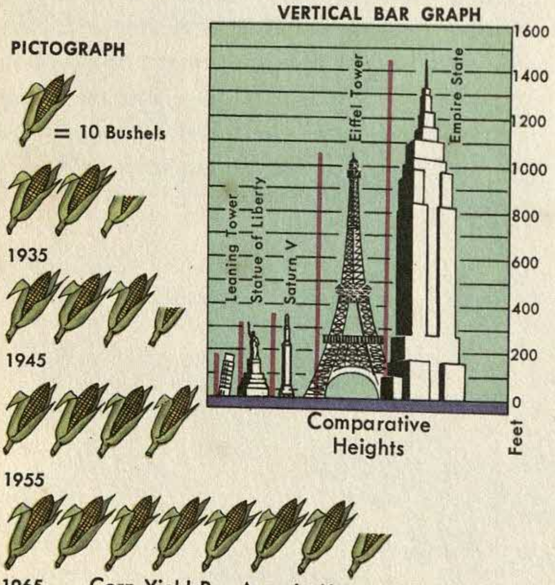
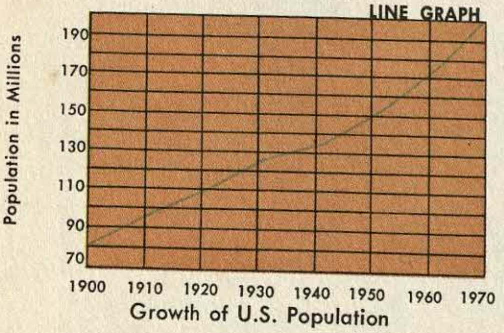


Corn Yield Per Acre in U.S.



Growth of U.S. Population

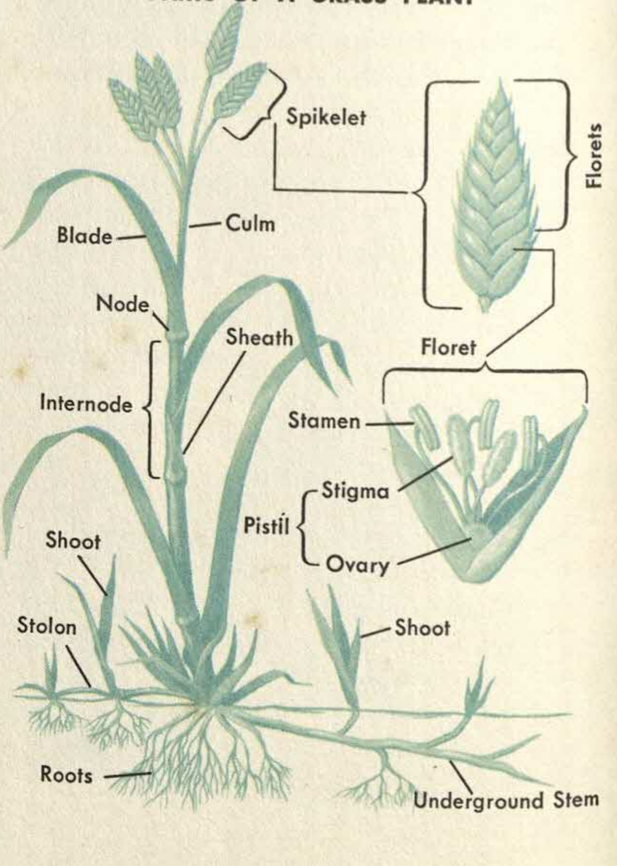
GRAPHS The air is made up of many gases. But there are different amounts of these gases. Almost four-fifths of the air is nitrogen. A little more than one-fifth is oxygen. Argon and all the others together make up only about a hundredth of the air.

Each of the top two diagrams at the left tells all that the paragraph above tells. The diagrams are simpler and easier ways of telling the story. Diagrams of such kinds are called graphs. The top graph is a circle graph. The second is a bar graph.

There are many kinds of graphs. Two other kinds are shown. The one with the pictures of ears of corn is a pictograph. The bottom one is a line graph. The other graph, like the second air one, is a bar graph. The two bar graphs differ, however, in the direction of the bars.

GRASSES If there were no plants, there could be no animals. For all animals get their food from plants. They do not all eat plants. They may eat animals that eat

PARTS OF A GRASS PLANT



plants. Or they may eat animals that eat animals that eat plants. But the food of every animal can be traced back to plants. We ourselves would have no food except salt and water if there were no plants.

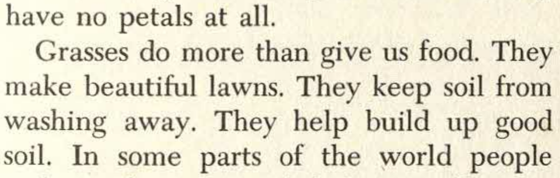
Almost every plant is good food for some animal. For us the most important food plants are the grasses. Our bread and cereal grains—rice, corn, wheat, rye, barley, oats, and millet—are all grasses. So are sugarcane and sorghum. So are the pasture grasses that feed our sheep and cattle.

Every continent except Antarctica has great stretches of grassland. Among them are North America's prairies.

Some grasses are low plants. Some are middle-sized. And some—some of the bamboos—are as tall as trees. All grasses have jointed stems. You may be surprised to know that grasses belong to the great group of flowering plants. Grass flowers, or florets, are so small and simple that many people do not recognize them as flowers. They have no bright-colored petals. In fact, they have no petals at all.

Grasses do more than give us food. They make beautiful lawns. They keep soil from washing away. They help build up good soil. In some parts of the world people make roofs or even whole houses of grass.

Although it would be hard to get along without the grass family, some grasses are weeds. Among them are crabgrass and quack grass. (See BAMBOO; BREAD; CEREALS; FLOUR; FLOWER FAMILIES; FORAGE CROPS; PRAIRIE.)



GRAVITY Even a champion high jumper can jump only about seven and a half feet off the ground. The earth pulls him so hard that he cannot jump any higher. The pull of the earth is called gravity.

Gravity makes water run downhill. It makes balls thrown into the air fall back down, and ripe apples drop from trees. Gravity keeps us all from being hurled off the earth as it whirls around. It keeps the moon traveling around and around the earth instead of shooting off into space.

Some man-made satellites have escaped from the earth and gone into outer space never to return. But to do so they had to take off from the earth at a speed of more than 25,000 miles an hour.

A person can easily find out how hard the earth is pulling him. All he has to do is weigh himself. If it weren't for gravity, no one would weigh anything at all.

Astronauts orbiting the earth in space capsules are weightless. Before anyone had made a space flight, scientists wondered whether a person could stand weighing nothing. Actually weightlessness has been no problem except for the nuisance of having to anchor every object in a space capsule in place to keep it from floating about.

All other bodies in the universe exert a pull just as the earth does. The pull of the sun keeps its whole family of planets from running away. (See NEWTON, ISAAC.)

GREAT BRITAIN There are two big islands in the British Isles—Great Britain and Ireland. Great Britain is the larger of the two. England, Scotland, and Wales are on this island.

Great Britain is not much larger than Utah. But it has 50 times as many people. (See BRITISH COMMONWEALTH; BRITISH ISLES; ENGLAND; SCOTLAND; UNITED KINGDOM; WALES.)

GREAT LAKES The Great Lakes are really great. Nowhere else is there such a chain of large lakes. There are five of them in the chain. Each one is among the 15 biggest lakes in the world.

Lake Superior is the largest of the five. It is almost exactly the same size as the state of South Carolina. After Superior come Huron, Michigan, Erie, and Ontario.

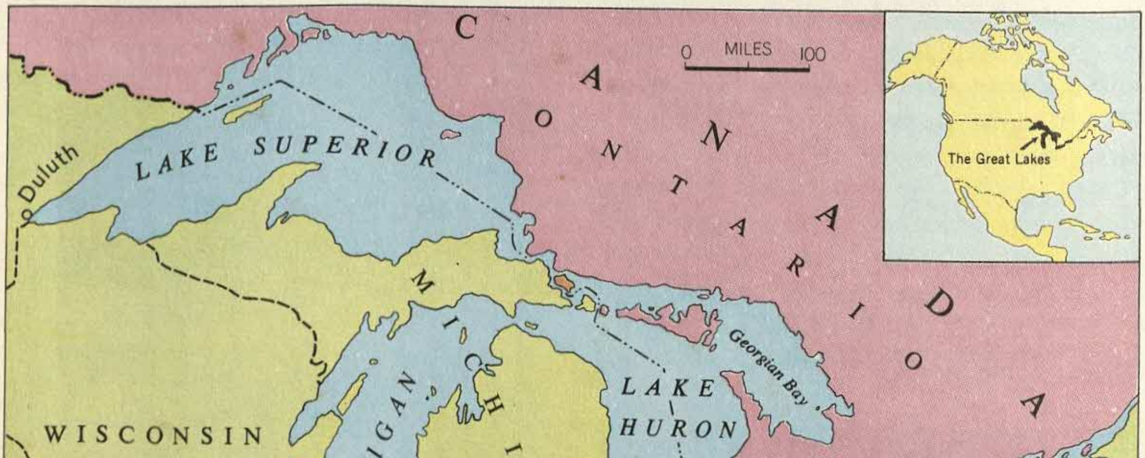
Lake Michigan is entirely inside the United States. The boundary between the United States and Canada runs through each of the other four.

In Chicago there is a beautiful fountain called "The Spirit of the Great Lakes." It has the figure of a woman to stand for each one of the lakes. Superior and Michigan pour their water into Huron's bowl. Huron empties her bowl into Erie's. Erie, in turn, empties hers into Ontario's.

The water in the Great Lakes is fresh. Many rivers bring water to them. The St. Lawrence River carries water from Lake Ontario to the Atlantic.

There was a time during the Ice Age when the Great Lakes drained down the Mississippi Valley to the Gulf of Mexico. The valley of the St. Lawrence was blocked by ice. Now a little of the water once more finds its way to the Gulf through a waterway. But most of the water flows eastward. On its way between Lake Erie and Lake Ontario it pours over Niagara Falls.

The Great Lakes have helped to make the United States and Canada great countries. The lakes form a waterway more than 1,000 miles long. No other inland waterway in the



world is so busy. Many of the boats that travel the lakes are loaded with iron ore, wheat, and coal. Several Great Lakes ports are very large cities.

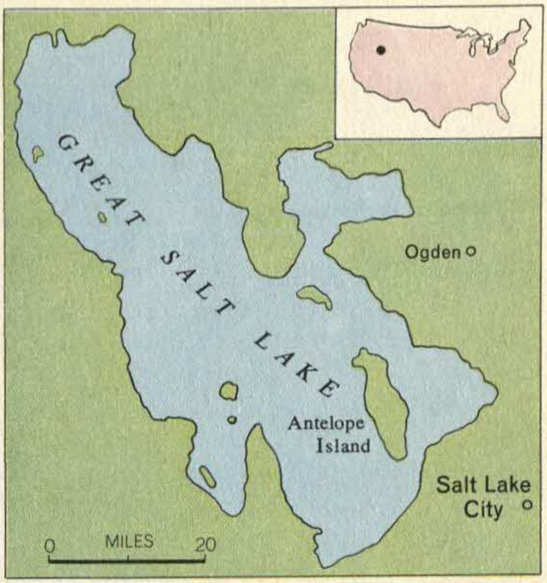
Canals have been dug to improve the lakes as a waterway. The Soo canals carry traffic between Superior and Huron. The St. Lawrence Seaway, which was opened in 1959, allows large oceangoing vessels to reach the lakes. No one could possibly measure in dollars how much the lakes are worth to the people who live nearby. They affect the climate of all the region around them. Near their shores orchards and vineyards flourish because the lakes protect them from damaging frosts. The lakes do much to make the climate pleasanter to live in, too. And they are a wonderful playground for sailing, fishing, and swimming.

Unfortunately, cities on the lakes have poured so many wastes into them that they are now seriously polluted. Beaches are being ruined and fish are dying. Everyone hopes that steps now being taken to fight pollution are not too late. (See ICE AGE; LAKES; WATER POLLUTION.)

GREAT SALT LAKE The largest lake in the western half of the United States is Great Salt Lake. This lake is very different from the Great Lakes. For one thing, it is shallow. On the average it is only 15 feet deep. Besides, its water is very salty.

This lake is left over from a much bigger one—Lake Bonneville. Lake Bonneville once covered most of what is now the state of Utah. It was a great freshwater lake 1,000 feet deep. Water poured down into it from the slopes of surrounding mountains. Through a gap in the mountains overflow water found a way to the sea.

But in time the climate of the region became much drier. Less water ran into the lake, and much that did evaporated. Finally the lake was losing more water each year than it got. Of course, the lake became shallower and smaller. At last no water ran out of it to the sea. The lake grew salty, for the water as it evaporated left behind salt it had gathered up from rocks on its way to the lake. Now the water is much saltier than seawater. Almost the only living things in Great Salt Lake are brine shrimps and tiny algae.



Swimming in such salty water is a strange experience. The water holds a swimmer up much more than fresh water does. If he floats, a third of his body is out of water. Diving is rather dangerous. A diver may be stunned when he hits the heavy water.

Some miles to the west of the present lake are the Bonneville Salt Flats. "Flats" is a good name for them, for they are probably flatter than any other natural surface on the earth. The ground is almost pure salt. On these salt beds there is an automobile racecourse. A racing car has traveled more than 600 miles an hour on it.

Salt Lake City is near Great Salt Lake. Some of the people of the city earn their living by mining salt. Lake Bonneville left behind enough salt to last the whole world for a thousand years and more.

The best way to get a good view of the lake is to fly over it. On a sunshiny day the very blue lake with its border of salt makes a picture it is not easy to forget. (See ALGAE; CASPIAN SEA; SALT; UTAH.)

Acropolis
Wrestlers
Socrates
Coin
Discus
Thrower
Vase
Theater
Mount Olympus
Statue
Grecian Woman with Zither
Greek House

GREECE The world of today owes a great deal to the ancient Greeks. From them came much of our learning. They gave us many of our ideas of beauty, too, and the idea of democracy.

About 3,800 years ago a Greek-speaking people moved into the mountainous peninsula of Greece, the western rim of Asia Minor, and hundreds of islands that dot the Aegean Sea. They settled in small valleys separated by hills or mountains. Each community had a fort on a low hill and below it a town of mud-brick houses. On small farms outside each town farmers grew wheat and barley and tended vineyards and olive orchards. They pastured their flocks and herds on valley slopes. These settlements became united into small kingdoms that lasted until about 1100 B.C. Homer's story-poems tell of the Trojan War and of other events in the days of the Greek kingdoms.

A period which is called the Dark Age of Greece then came. It ended as the period of classical Greece began.

In classical times each town with its farmland was called a city-state. There were many city-states, but the chief ones were Athens, Sparta, Corinth, and Thebes.

With the great sea at their door, the Greeks became a sea-trading people. They learned about trade from black-bearded Phoenician traders from across the Aegean and the Mediterranean. Greek nobles bought from them jewelry for their wives and robes dyed with beautiful Tyrian purple. From the Phoenicians, too, they learned about the alphabet and borrowed it for writing their own language. They began making silver into coins. Writing and money helped Greek business.

The Greeks soon had better ships than the Phoenicians and went ahead of them in sea trade. By 600 B.C. Greek trading posts and colonies stretched along the northern Mediterranean shore from the Black Sea almost to the Atlantic. One of the most successful colonies was Syracuse in Sicily. Another was Byzantium, now called Istanbul.

Workshops employing slave workmen made beautiful pottery, textiles, and metal wares for trade with other lands. The Greek ships brought home much grain and fish. Shipbuilders built warships to protect the merchant fleets. Merchants and workshop owners grew wealthy.

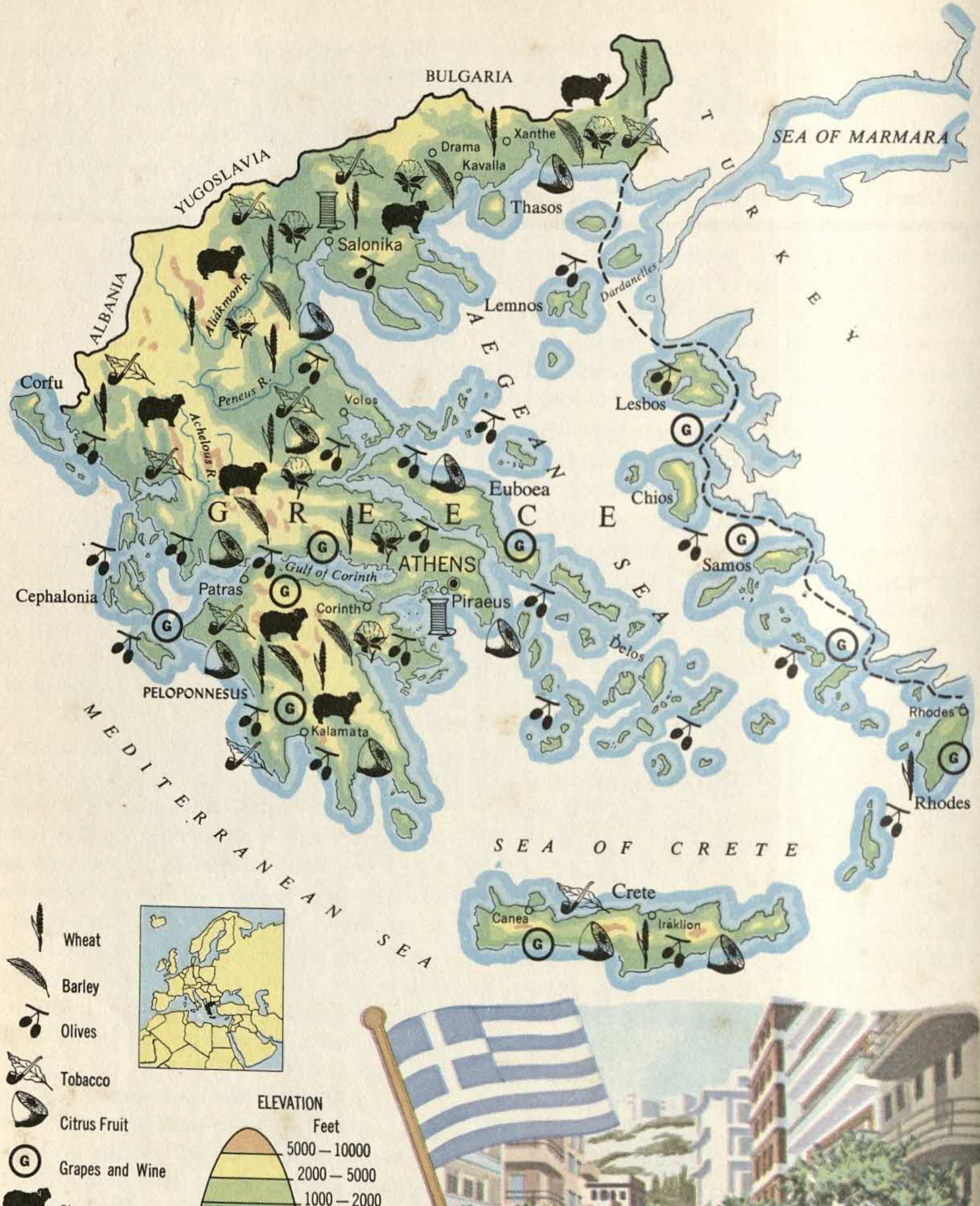
In Athens these newly wealthy men compelled the ruling nobles to share the government with them and with all the citizens. By 500 B.C. the Athenians had set up a democratic government. All freemen could take part in the Assembly, the lawmaking body of the city-state. The Assembly sat on the grass in an open-air meeting place. Members voted by raising their hands.

Then arose a great threat to liberty. The powerful king of Persia sent his armies by land and sea against Athens. In the Battle of Marathon in 490 B.C. the united "Greek spears" led by Athens defeated the "Persian bows and arrows." In the sea battle of Salamis in 480 B.C. the Athenians defeated the Persian navy.

After the Persian war the Athenians entered a Golden Age. They rebuilt their city, burned down by the Persians. Their new homes were still of mud brick, but they contained beautiful furnishings. Boys went to school at their teacher's house, attended by an old slave. He carried their roll books. Greek boys studied music, reading, writing, and poetry. Girls stayed at home. Young men practiced boxing, wrestling, and running in order to prepare for the famous Olympic games.

On a hill called the Acropolis the Athenians built a majestic marble temple—the Parthenon. It honored the goddess Athena, the protector of Athens. The young leader Pericles planned it; Phidias, the most famous sculptor of his time, carved its marvelous decorations.

Many men of learning arose in the Golden Age. Sophocles and Euripides wrote plays for the open-air theater below the Acropolis. The great teachers Socrates and Plato held learned discussions with young



Total population 8,612,000
Area (square miles) 50,944

citizens in the marketplace. Modern medicine started with the physician Hippocrates. Aristotle argued that the earth is round over 1,800 years before Magellan's ship "Victoria" proved it in 1522.

The Golden Age faded. Rivalry brought on wars between the city-states. From the north King Philip of Macedon led his armies into Greece and conquered all but Sparta. They became a part of the vast empire of his son, Alexander the Great. Alexander did not think much of democracy, but he liked Greek art and learning. Throughout his empire he spread Greek architecture, sculpture, and science. Much later the Romans, who conquered Alexander's empire, carried Greek ideas to western Europe. From there these ideas spread far and wide.

Greece, long under the rule of Turkey, won her independence in 1829 and became a kingdom in 1830. The period of World War II and the next few years were troubled ones for the small country.

Most of the people of Greece today get their living from the soil and the sea just as the ancient Greeks did. Not much manufacturing goes on. Shipbuilding and making textiles are two of the main industries.

Unfortunately there are so many mountains and lakes in Greece that less than a third of the country's area can be used for fields and orchards. And during the centuries much of the soil has been worn out. Almost all the forests, moreover, have been cut down. But Greece is replanting her forests and rebuilding her soil. Some land thought until recently unfit for farming is being used to raise rice.

Much of the farmland is used for crops that can be sold to other lands to pay for meat, wheat, and flour. Like all the countries on the northern shores of the Mediterranean, Greece has a good climate for olives, citrus fruits, grapes, and tobacco. It produces cotton, too. Tobacco, cotton, olives, and fruits, among them the small dried grapes called currants, are important exports. The farmers have some livestock—chiefly sheep and goats.

From the sea the fishermen get sponges, about 100 tons a year. The boats of the sponge fishermen are one of the colorful sights of Greece. And as in days of long ago Greek ships carry cargoes far and wide over the seas. Few nations in the world have more merchant ships than Greece.

Athens, the capital and largest city, attracts many visitors. It has many relics of Greece's early glory. (See ACHILLES; ALEXANDER THE GREAT; ALPHABET; ARCHIMEDES; ARISTOTLE; CRETE; GREEK MYTHS; HISTORY; HOMER; MYTHS AND LEGENDS; OLYMPIC GAMES; SOCRATES; TROJAN WAR.)

GREEK MYTHS Back near the beginning of things, an old Greek story goes, there was only one woman on the earth. Her name was Pandora. The gods had sent her down to earth from Mount Olympus, their home. She became the wife of Epimetheus. As she was leaving Mount Olympus, Zeus, the king of the gods, had given her a golden casket and told her never to open it.

Soon Pandora became so curious that she decided to take just one peek. As she lifted the lid, a swarm of horrid little creatures escaped. They flew about stinging people and making them cry with anger and pain. No one could catch them to put them back in the box. Up to that time there had been no sickness or sorrow on the earth. Pandora then heard a tiny voice coming from the casket. She looked in again and saw a beautiful little creature. It was Hope.

A story of this kind is called a myth. There are many other Greek myths. The Greeks made them up to explain things they could not understand. They told the story of Pandora to explain why there are sicknesses and sorrows and why there is always hope that things will be better.

The myths of the Greeks were closely tied up with their religion. In most of them their gods and goddesses play an important part. The pictures show some of the characters in these myths.

With the help of the goddess Athena, the young man Bellerophon captured Pegasus, the winged horse of the Muses, goddesses of the arts. Together Bellerophon and Pegasus performed heroic deeds. But when Bellerophon tried to ride Pegasus up to Mount Olympus, he was thrown off. Pegasus returned alone to his home on Olympus.

Daedalus, a wonderfully clever Athenian, had taken refuge in Crete after killing his nephew in a surge of anger. Later he wished to leave Crete, but the king would not let him do so. To escape, Daedalus built wings for himself and his son Icarus. He warned Icarus not to fly too close to the sun. But Icarus was too eager to fly

EDUCATION

to heed the warning. The wax in his wings melted, and he plunged into the sea.

Every year, the story of Theseus tells, Athens had to send seven youths and seven maidens as a tribute to Crete. There they were thrown to a monster called the Minotaur. Theseus asked to be sent as one of the youths. He had decided that the Minotaur must be killed. With the help of the daughter of the king of Crete Theseus slew the monster and saved the captives.

The Gorgon Medusa had snakes for hair. She was so ugly that the mere sight of her turned a person to stone. Perseus with the help of a helmet that made him invisible, was able to come close to her. By using his shield as a mirror, he cut off her head without looking directly at her. Another feat of this hero was to rescue the beautiful princess Andromeda. Andromeda had been chained to a cliff as a sacrifice to a sea monster.

Pygmalion, a sculptor, fell in love with Galatea, a statue he had made. In answer to his prayers the goddess of love brought the statue to life.

Hercules was given 12 labors to perform. One was to capture the sacred stag belonging to Artemis, the goddess of the hunt. He did so by running after it day and night for a whole year. Another was to kill the seven-headed Hydra, a huge snake that crept out of the marshes to slay cattle.

The gods gave Atalanta the gift of fleetness. She promised to marry any young man who could outrun her. But anyone who tried and failed was put to death. The goddess of love gave Hippomenes three golden apples. During the race he flung them, one at a time, ahead of Atalanta. She stooped to pick them up and lost the race.

Many Greek myths are nature myths. They explain such things as what holds up the earth, why the seasons change, and how the different groups of stars came to be in the sky. Such nature myths can be called the forerunners of science. (See ROMAN GODS AND GODDESSES.)

New York Tribune.

GREELEY, HORACE (1811-1872) Newspapers have played an important part in America's history. Some of them, of course, have been much more important than others. How much power a newspaper has depends chiefly on how good an editor it has. Horace Greeley is one of the most famous of all American newspaper editors.

Greeley did not have much education. He went to work in a printing office when he was only 15. He was the kind of helper called a "printer's devil." It was not long before Greeley decided that he wanted to run a newspaper of his own. At 20 he went to New York, where he found work as a printer and then as an editor. In 1841 he started the *New York Tribune*, a newspaper that lasted for 83 years. Then it merged with the *Herald*. As the *Herald Tribune* it lasted until 1966, when it merged again. The end finally came the next year when the resulting newspaper, the *World Journal Tribune*, printed its last paper on May 5.

In his newspaper Greeley fought against slavery. He fought against saloons and gambling and capital punishment. He also fought against letting women vote. Not all of Greeley's ideas were good, but he thought that they were and worked hard to bring others to his way of thinking.

Fortunately people did not have to read Greeley's ideas in his handwriting. It was so poor that it could truthfully be said to look like chicken tracks.

Greeley's advice, "Go West, young man, go West," became famous all over the United States. Greeley was sure that the West held the greatest promise for the nation's future. (See NEWSPAPERS.)

GREENHOUSE Glass houses built to protect growing plants are called greenhouses. The glass allows sunlight in, and then keeps the heat of the sunlight from escaping. A heating system furnishes extra heat when needed. A caretaker supplies water and good soil so that plants have everything they need for growing.

One good reason for having greenhouses is that plants can be started in them early in the spring while it is still cold out of doors. When it is warm enough and there is no longer danger of frost, the plants can be transplanted from their home under glass to the garden. Tomatoes and cabbage are two vegetables which are often started early in spring under glass.

Greenhouses also help make it possible for us to have flowers and fresh vegetables all through the year. In the seasons when there are no plants growing in outdoor gardens, a greenhouse owner can sell flowers or vegetables from his greenhouse.

Many experiments are done with plants in greenhouses, too. From these experiments scientists have found out a great deal about what plants need in order to grow well. They have also found out a great deal about plant diseases.

In some parts of the world people would never see orchids or banana plants or giant ferns if there were no greenhouses. Greenhouses called conservatories have on display plants that are very different from those growing naturally around us.

Most of the people of Greenland are Eskimos.

GREENLAND About a thousand years ago a Norse chieftain, Eric the Red, discovered Greenland, the biggest island in the world. Greenland is far to the north between Europe and the mainland of North America. Its northernmost point is only 448 miles from the North Pole. Much of Greenland has months of continuous night in winter and of continuous day in summer.

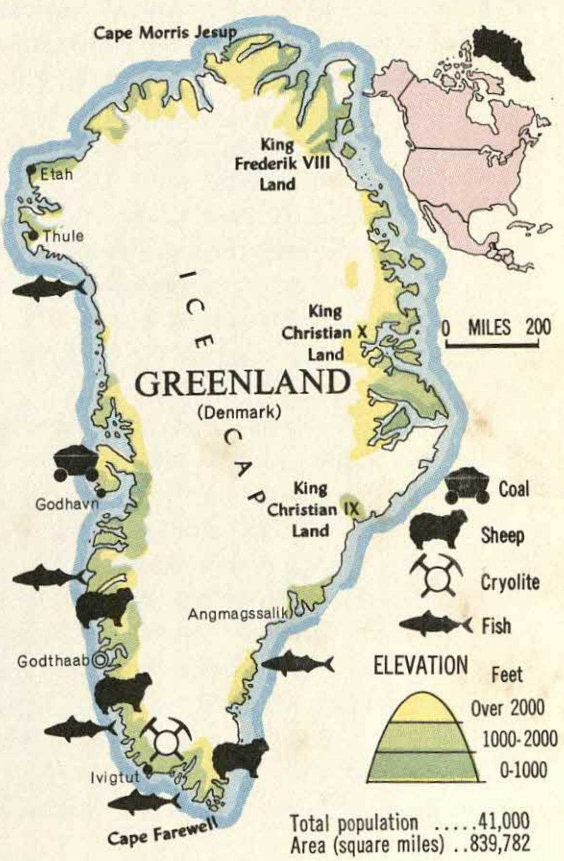
Most of Greenland is covered by a great ice cap. In the center the ice is more than a mile deep. A few bare rocky peaks rise above this thick sheet of ice. In some places the ice sheet comes all the way down to the sea. But around the edge of the island there are narrow strips of ice-free land where people can live.

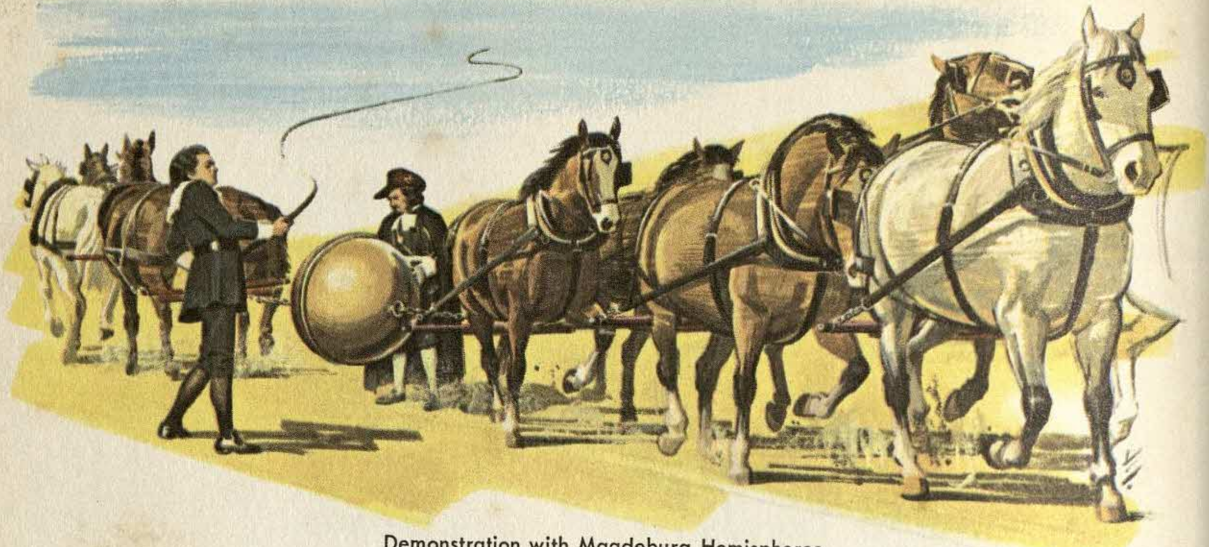
It is not surprising that only about 40,000 people live in Greenland. Most of them are Eskimos, or Greenlanders. Besides, there are about 2,800 Europeans, mostly Danes. Greenland is a part of Denmark.

Most Greenlanders earn a living by fishing. They do not wander about as many of the Eskimos of the North American mainland do. Instead, they live in small villages. On land they travel chiefly by dogsled.

A thousand or so Americans are stationed at United States bases in Greenland. Most of their work has to do with forecasting the weather or with the DEW line. The DEW line is a warning system. The chief American base is at Thule.

Greenland has fish to sell. It also has cryolite, a mineral used in getting aluminum from its ores. (See ESKIMOS.)





Demonstration with Magdeburg Hemispheres

GUERICKE (GAY ri ke), **OTTO VON** (1602–1686) About 300 years ago a German scientist sent word to his emperor that he wished to show him an experiment. The scientist was Otto von Guericke. The picture above shows the experiment. The big ball was hollow and was made in two halves that were not fastened together. With an air pump he had invented, Guericke pumped out most of the air from inside the ball. Then the air on the outside held the two halves together. It pushed on them with so much force that teams of horses could not pull them apart.

In many science classes today boys and girls try this same experiment. But the balls they use are only a few inches across. The balls are called Magdeburg hemispheres. They get this name because Guericke was the mayor of the city of Magdeburg.

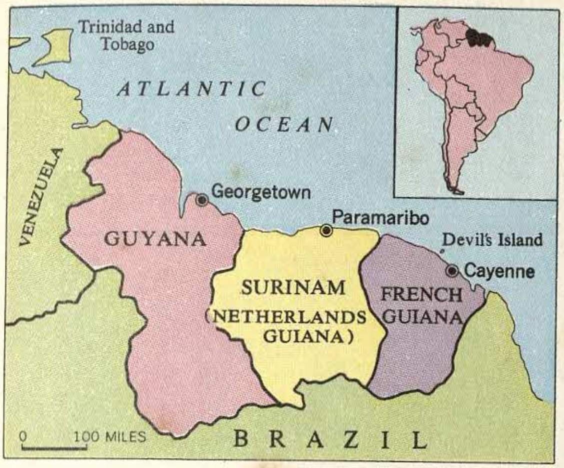
Guericke carried on many other experiments. He experimented with electricity and invented a machine for producing sparks of electricity. He studied winds and weather and built a water barometer.

This water barometer had a glass tube more than 30 feet tall that reached up through the roof of Guericke's house. The tube was almost filled with water. A little wooden figure floated on the water. On clear days the water rose, and the little figure appeared above the roof. On cloudy days the water went down in the tube, and the little figure disappeared below the roof. The neighbors did not understand a barometer. When they saw the little figure appear and disappear, they said that Guericke was in league with the devil. It was not easy to be a scientist 300 years ago. (See AIR; BAROMETER.)

GUIANAS Three little countries on the northern coast of South America have long been called the Guianas. They are Dutch Guiana, or Surinam, French Guiana, and Guyana. Surinam is a part of the Netherlands, and French Guiana a part of France. Guyana, which was formerly named British Guiana, became an independent nation in the Commonwealth in 1966.

There is much beautiful scenery in the Guianas, but not many see it. The coastal lowland is hot, rainy, and uncomfortable to live in. Most of the land away from the coast is high, rugged, and covered with dense forests. The countries are not on any main steamship or airline routes. They have few roads and almost no railroads.

Most people in the Guianas live in the lowland. Among them are native Indians and some Europeans. Their homes are in the cities or on sugar, rice, and other plantations. Europeans have brought in many Africans, Asiatic Indians, and Indonesians



to work on the plantations. In earlier times France used Devil's Island as a colony for convicts.

Near streams in the forests there are scattered Indian villages and villages of people descended from Negroes who ran away from plantations in the days of slavery. The village people travel in canoes. They raise a little food and catch fish. Often they shoot the fish with bows and arrows.

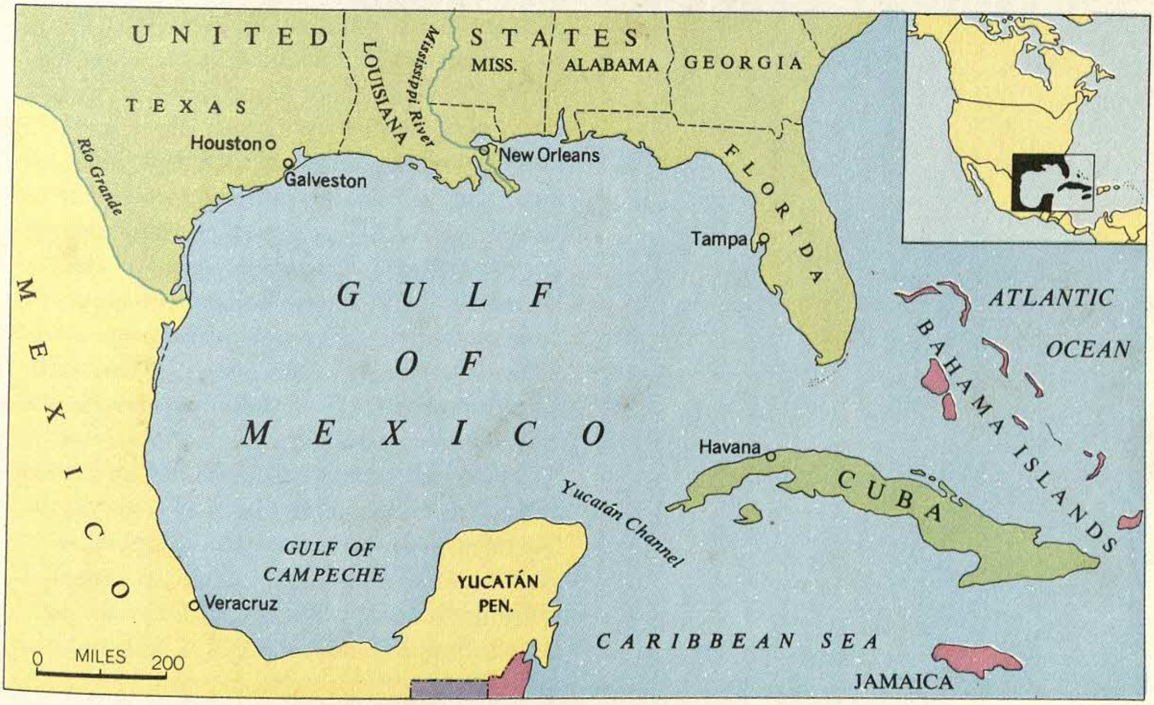
The United States gets much bauxite, an aluminum ore, from Surinam. All three Guianas have rich deposits of this ore.

GULF OF MEXICO The Gulf of Mexico is a big arm of the Atlantic Ocean. Five of the southern states of the United States have seacoasts on the Gulf. As you see from the map, they are Florida, Alabama, Mississippi, Louisiana, and Texas. Mexico has about 1,500 miles of Gulf coast.

The Mississippi River flows into the Gulf of Mexico. New Orleans, one of the two great Gulf ports, is near the mouth of the Mississippi. The other great Gulf port is Houston. It is on a ship channel leading in from the Gulf.

Warm winds often blow from the Gulf over the eastern half of the United States. These winds bring much rain to that part of the country. From time to time hurricanes sweep across the Gulf and do damage to the coastal regions.

The Gulf is a busy highway. Ships go between its ports and ports all over the world. Many of these ships are oil tankers or fruit boats. Others carry cotton, sulfur, or chemicals. Some are passenger ships. Many of the ships which leave Gulf ports are bound for South America. (See HOUSTON; MEXICO; NEW ORLEANS.)

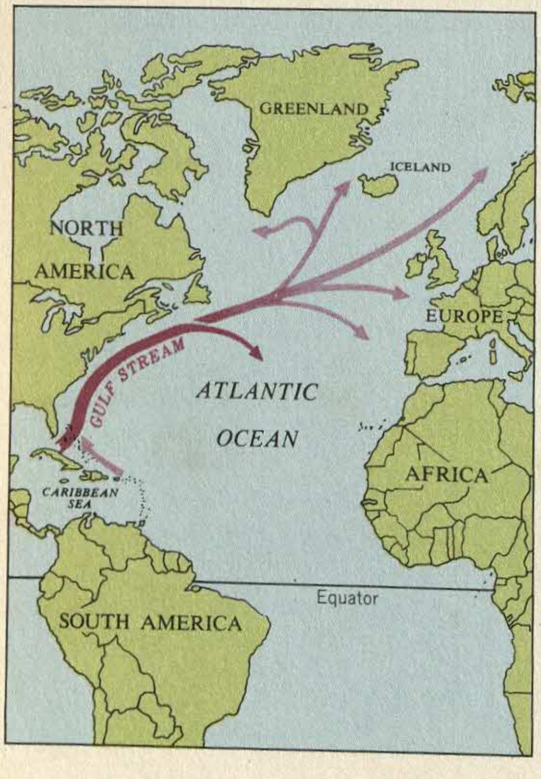


GULF STREAM In the oceans there are great "rivers" called ocean currents. The Gulf Stream is the largest and most important of these ocean currents.

The Gulf Stream is a current of warm water which flows out from the Gulf of Mexico between Florida and Cuba. For a way it travels along the east coast of the United States. Then it swings eastward in the Atlantic Ocean.

As it leaves the Gulf it is a very blue stream of water many miles wide and several hundred feet deep—far larger than the Mississippi River. And it is traveling fast—some 100 miles a day. It slows and broadens out as it moves northward.

The Gulf Stream is often 20 degrees warmer than the "Cold Wall," the water between the Gulf Stream and the coast. West winds blowing across the Gulf Stream carry some of its warmth to the countries of northern Europe. England is as far north as Labrador, but the Gulf Stream helps make its climate much pleasanter. (See ATLANTIC OCEAN; OCEANS.)

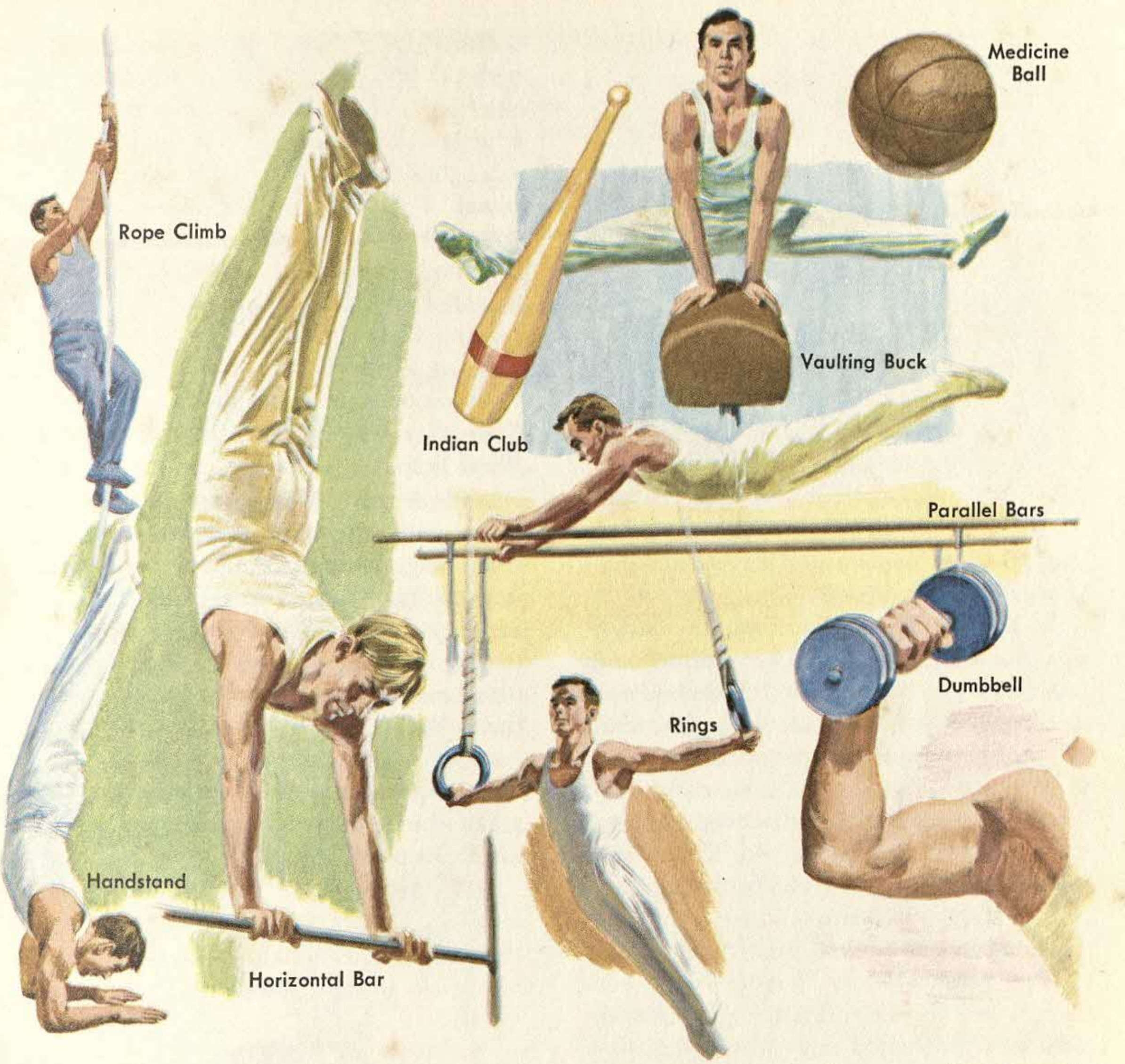


GUTENBERG, JOHANN (1400?–1468) Printing with movable type was one of the most important of all inventions. Credit for this great invention is usually given to Johann Gutenberg, a printer who was born in the city of Mainz in Germany.

Long before Gutenberg's time the Chinese and Koreans had used movable type made of baked clay. But their invention did not reach Europe. Printing had to be invented all over again there.

The story of the beginning of printing in Europe is not very clear. On no actual printed piece is Gutenberg named as the printer. Early printers may have tried to keep their way of making books secret so that buyers would not know that their books were not written by hand. It is certain that Gutenberg did print with separate type letters he had cast by pouring molten metal into molds he had made. Not many people question that he was the first to do so. When he died he left behind many of his type molds and printing instruments.

The Gutenberg Bible is one of the earliest printed books. For years Gutenberg was given full credit for printing it. Now it seems clear that the credit should be shared with Peter Schoeffer. In any event, the Gutenberg Bible is one of the most valuable books in the world. As much as half a million dollars has been paid for a single copy. (See BIBLE; BOOKS AND BOOKBINDING; PRINTING.)



GYMNASTICS The word "gymnastics" comes from the same old Greek word that "gymnasium" comes from. The word means "naked." Gymnastics are exercises meant to make the body strong. Greek gymnasts wore no clothing as they exercised.

Today there are many gymnastic meets. Some are high-school or college meets. Others are a part of such international competitions as the Pan-American and Olympic games. Not all meets have the same events. Common events are the horizontal bar, parallel bars, still rings, long horse, side horse, floor exercises, tumbling, and trampoline. Others are flying rings, balance beam, and rope climb.

GYPSIES Fortune-tellers are often dressed as gypsies. Sometimes they are real gypsies. For telling fortunes is one of the chief ways in which gypsies make a living.

Gypsies are a nomadic people without a nationality of their own. For centuries they have wandered about from place to place and country to country. No one knows much about their early story. About 600 years ago tribes of gypsies wandered into Europe from Asia. They are believed to have come in the beginning from India. Gypsies are dark-skinned and black-haired like the people of India. And their language makes scientists think that they came from India. The first gypsies to arrive in Britain were

said to have come from Egypt. "Gypsy" is short for "Egyptian."

In Europe the gypsies kept on wandering, moving northward in summer and southward in winter. They traveled in wagons pulled by horses. At night they built big campfires and sang songs around them.

The gypsies were soon famous for their horse trading and their fortune-telling. Some of them were good smiths, too. They earned money by mending pots and pans. And many were good musicians. Some composers have used gypsy tunes in their music.

The gypsy life would seem to be very happy and carefree. But the gypsies were seldom well treated anywhere. Often they had to steal to get enough food. Because other people feared and distrusted them, they were driven off and at times even killed or put in prison and tormented.

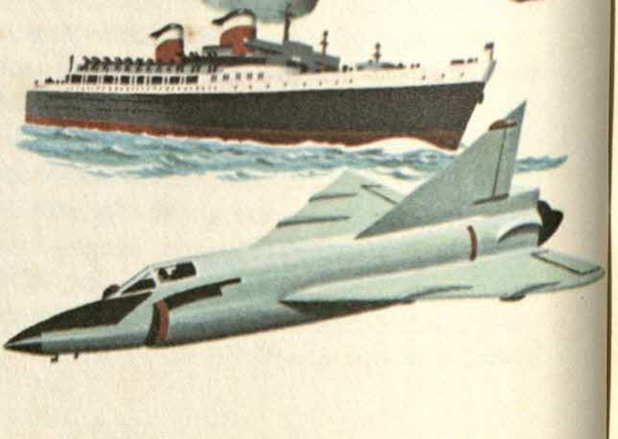
From Europe some gypsies journeyed to America and Australia. In all their travels gypsies have kept much to themselves. They cling to their own customs and language. Their language is called Romany.

There are thousands of gypsies in the United States now. In their wanderings today they use mostly house trailers instead of horses and wagons. Many spend the winters in cities. With their gay clothes and bright jewelry they are easy to tell from other people. (See NOMADS.)

GYROSCOPE Many of you have played with a toy gyroscope, or gyrotop. The chief parts of a gyrotop are a wheel, which is weighted around the rim, and a rod, or axle, that goes through the center of the wheel. To spin a gyrotop, a string is first wrapped around the axle. Then the string is pulled suddenly as the end of the axle is rested on something solid. As long as a gyrotop keeps spinning, its axle keeps on pointing in the same direction.

Gyroscopes today are far more than toys. They play an important part in weaponry. They help, for example, in the flight of guided missiles. Gyrocompasses are used along with magnetic compasses on most ships. Big gyroscopes are used to steady ships in rough seas. And gyropilots are used to keep ships automatically on a straight course. Airplanes, too, use gyroscopes. In fact, today's airplanes could not do without them. Directional gyroscopes and artificial horizons made of gyroscopes are among the most important airplane instruments. They make the much-used automatic pilots for airplanes possible.

Only gyrotops are set to spinning with a string. Other gyroscopes are set in motion and kept spinning with electricity or jets of air. (See COMPASS.)



The letter *H* can be traced back to the letter 𐤇 in the Phoenician alphabet. In the beginning the letter may have come from the same picture that *E* came from—the picture of a lattice window or fence, or, as some scholars say, of a man praying or shouting for joy, . The Greeks wrote it two ways after they borrowed it from the Phoenicians: 𐌇H. The simpler form came to be the Roman way of writing it. It has come down to us by way of the Romans unchanged.

H is pronounced in such words as *hate, home,* and *hear,* but in a great many words it is silent. *Hour, honor, ghost,* and *vehement* are a few of them.

HABITS If we had to think of each step we took as we walked down the street, it would take us a long time to walk even one block. It would take a great deal of time if we had to think how to make each letter in writing our names. We do so much walking and writing after learning how that the way we walk and the way we write are habits.

We depend on a large number of habits when we dress in the morning. Tying bows, buttoning buttons, snapping snaps, and zipping zippers are all habits. Using knives and forks and spoons as we eat is a habit. Brushing our teeth after meals is a habit. Turning off lights when we leave a room and waiting for a green light at street corners are also habits. Our lives would not be at all as they are now if there were no such thing as habit and we had to think carefully about everything we do.

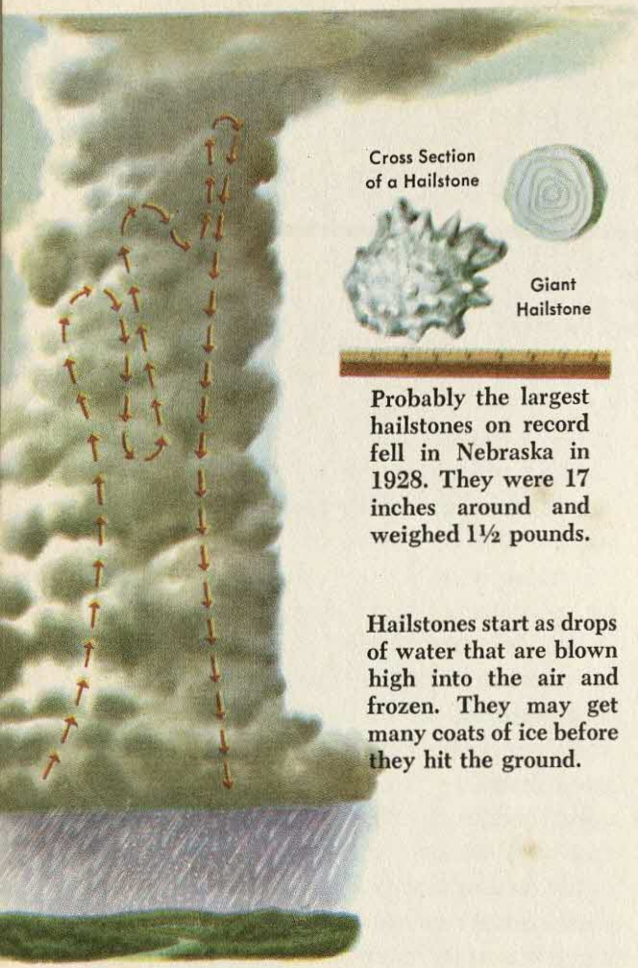
We form a habit by doing the same thing over and over again. But want and need have a great deal to do with forming habits. Walking would not become a habit if we had no wish to go places.

Although habits are very important to us and most of them may be good, we all have some bad habits. Many people have formed the habit of standing or sitting in bad positions. Some people have the habit of biting their fingernails. Some have the habit of telling lies. Some people have bad eating habits. A long list of bad habits could easily be made.

If you are learning to do anything new, it is a good plan to make sure you are doing it the right way. It is usually easier to form a good habit than to break a bad one.

HADES The people of ancient Greece thought that the earth was flat. Down below it, they believed, there was a great, gloomy region to which people went when they died. This underworld the Greeks called Hades after the name of the god who ruled it. Pluto was another name for this god of the underworld.

To enter Hades the spirits of the dead had to cross a broad river—the Styx. Near the bank of the river an old boatman, Charon, was always waiting to ferry across those that had been given proper burial. A huge many-headed dog bristling with snakes stood guard at the gate of Hades to keep anyone who entered the underworld from escaping. The name of this dog was Cerberus. (See GREEK MYTHS.)


Cross Section of a Hailstone
Giant Hailstone

Probably the largest hailstones on record fell in Nebraska in 1928. They were 17 inches around and weighed 1½ pounds.

Hailstones start as drops of water that are blown high into the air and frozen. They may get many coats of ice before they hit the ground.

HAIL AND SLEET When raindrops start down from the clouds to the ground, they may fall into a layer of very cold air. If the air is cold enough, the raindrops freeze. When they reach the ground they are tiny balls of ice. These tiny balls of ice are called sleet.

Sleet is most likely to fall in late autumn, winter, and early spring. Oddly enough, much larger balls of ice often fall in summer. We call these big balls of ice hail. A single ball is a hailstone.

Hail usually falls during a thunderstorm. Even on hot summer days there may be a layer of very cold air only a mile or two above the ground. The top part of a thunderhead is usually made up of a mixture of snow crystals and droplets of supercooled water. The picture tells a large part of the story of how a hailstone is formed. A frozen drop of water grows as it is held up in the cloud and buffeted about by strong currents of air moving upward from the hot ground. As the hailstone is bounced about, it captures more and more water droplets. They freeze and make the hailstone larger. When a hailstone is finally heavy enough to fall through the strong upcurrent of air, it may be as big as a baseball, or even bigger. Fortunately, most hailstones are less than an inch across.

Scientists have been able to read the story of hailstones partly by cutting them open. Hailstones are all made of layers of ice, sometimes as many as 25. Clearly they are built up gradually.

Hail can do a great deal of damage. The balls of ice are big enough to break the windows of greenhouses. They level fields of grain. They ruin flowers and tear leaves off trees and bushes. They may even kill chickens. Large hailstones may badly damage aircraft. It is fortunate that hail does not come with every thunderstorm.

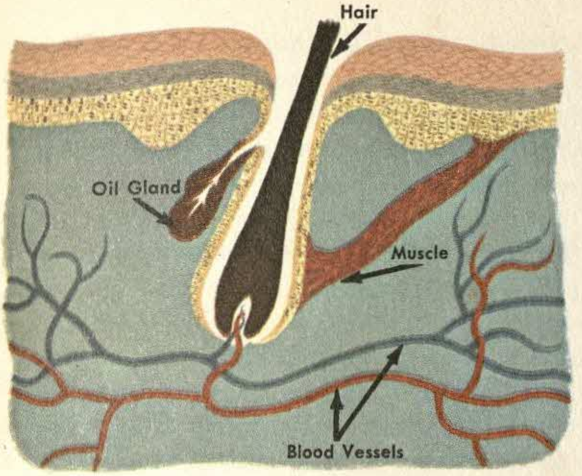
HAIR A lamb's wool, a kitten's fur, and a little girl's curls are all hair. Only mammals, the animals that feed their babies with milk, have hair. They all have some, even though such mammals as whales and hippopotamuses have very little.

A human being has a covering of hair almost everywhere except on the palms of his hands and the soles of his feet. But over most of his body the hairs are too short and fine to show very clearly.

Under a microscope the hair of different animals may look quite different. The hair of different people may show very clear differences, too.

Most hair has some coloring matter, or pigment, in it. White hair has none.

A person's hair may be coarse or fine, thick or thin, straight or curly. But it all grows from the skin in the same way. Each hair has a root. A small blood vessel brings food to the hair root. Otherwise the hair could not grow. At each root there is a



tiny muscle. There is also a tiny nerve. When hair "stands on end," the nerve has brought a message to the muscle and the muscle has pulled the hair into a stand-up position. Little oil glands in the skin keep the hair oiled.

Hair is a great help to mammals. A thick covering shuts in the heat of an animal's body. It is also a protection from injury. Almost all mammals, moreover, have special hairs which, like a cat's whiskers, are sensitive to touch.

People find the hair of other animals very useful. Fur coats are made of the skin and hair of some animals. Cloth and rugs are made from hair, especially from the wool of sheep. Many brushes are made of stiff animal hairs, or bristles.

HALE, NATHAN (1755–1776) "I only regret that I have but one life to lose for my country." These words are famous as Nathan Hale's last words.

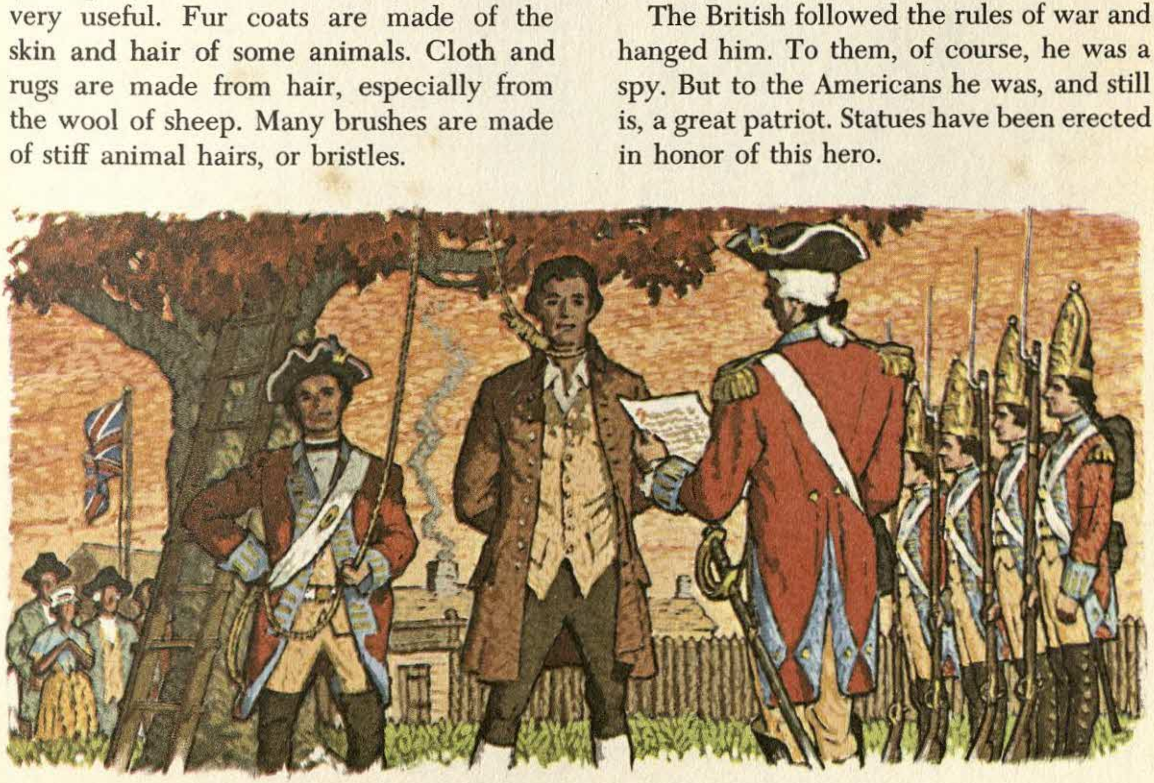
Nathan Hale was a young schoolteacher in Connecticut when the American Revolution began. He joined a Connecticut regiment at once as a lieutenant. He was soon made a captain.

In 1776 Washington had been defeated in the Battle of Long Island and things looked dark for him and his troops. He needed to know more about what the British were planning to do. He asked someone to volunteer for the dangerous task of going back of the British lines to find out what was going on. Nathan Hale volunteered.

Hale's friends tried to persuade him not to go. He was so popular and so capable, they said, that he would be missed too much if he were lost. But he went.

By pretending that he was a Dutch schoolteacher, he got through the British lines. Soon he had a great deal of information for Washington. But on his way back to the American camp he was caught.

The British followed the rules of war and hanged him. To them, of course, he was a spy. But to the Americans he was, and still is, a great patriot. Statues have been erected in honor of this hero.



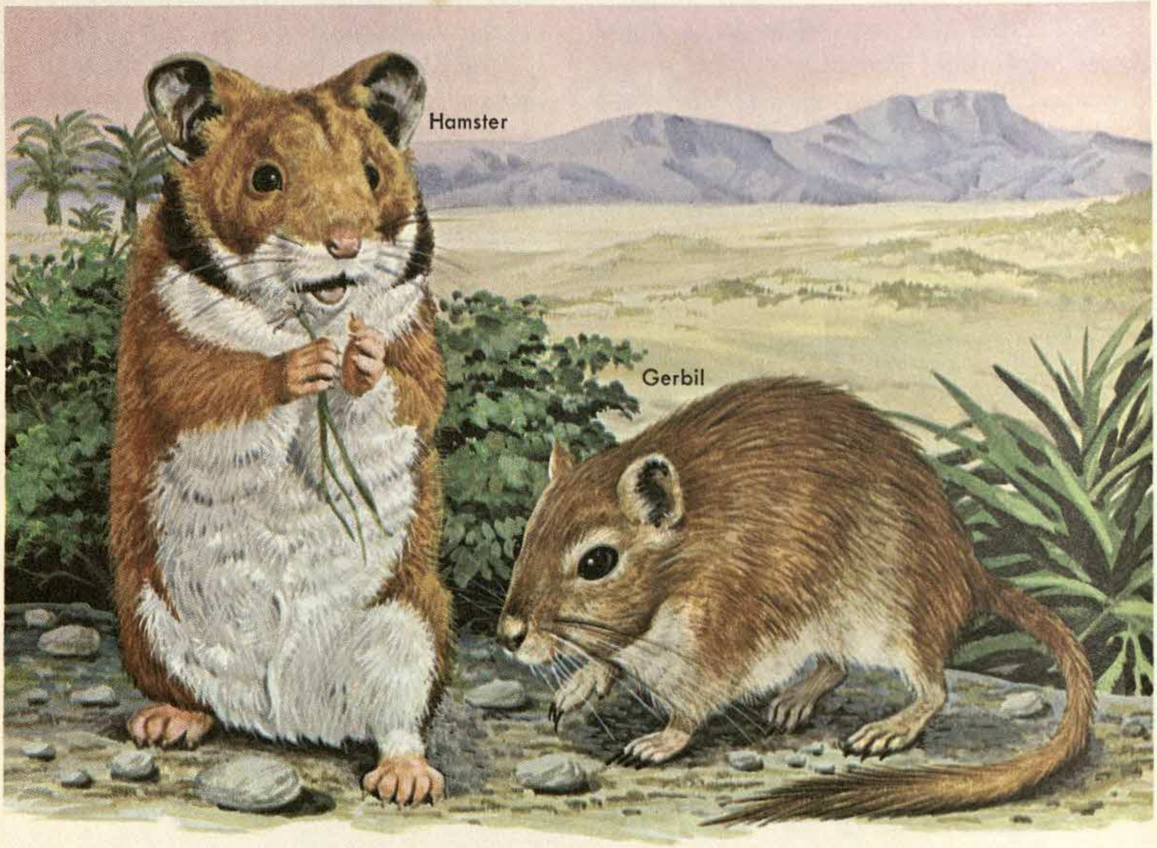
HALLOWEEN The night of October 31 is Halloween. The word "Halloween" is short for "Allhallows' even." "Hallow" means "saint." The evening gets its name because the next day, November 1, is a church festival called All Saints' Day.

But the things we do to celebrate Halloween have nothing to do with the church. They have come down to us from early days in Britain. In those days October 31 was the last day of the year there. It was a time for fun much like the fun we now have on New Year's Eve. On the night of October 31 witches and ghosts and goblins were supposed to be about, too.

Jack-o'-lanterns are one of the commonest signs of Halloween now. But witches and ghosts and black cats are also used a great deal for Halloween decorations. Many Halloween games are rather spooky.

HAMSTER AND GERBIL These two small animals can be bought at pet shops. They are cousins of the squirrels and chipmunks. Both of them are natives of dry lands in Asia and Africa.

The friendly hamster has been a popular pet in America for 25 years or so. The hamster pets of America are Syrian golden hamsters. They get this name because they are descendants of a family of golden-brown hamsters found in a burrow near Aleppo, Syria. They were first brought to America in 1938 for use in medical experiments. But they are so soft and cuddly that some were bound to become pets.



Gerbils were first brought here in 1954. They, too, were wanted for use in medical experiments. By 1965 they were becoming popular as pets. Gerbils won favor partly because they are very gentle; they almost never bite.

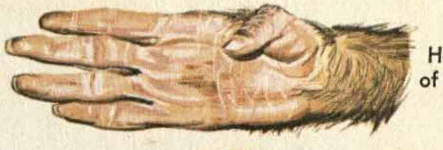
Although hamsters and gerbils are related, it is not at all hard to tell them apart. Gerbils have long tails; hamsters have none. Gerbils have long hind legs; they are good jumpers. Hamsters are not at all kangaroo-like. Hamsters are chubbier than gerbils. During the daytime they are less wide-awake and active. In their native home they spend most of the day in their burrows and go hunting for food at night. Gerbils live in burrows, too, but are out of their burrows often during the day. They are inquisitive little creatures.

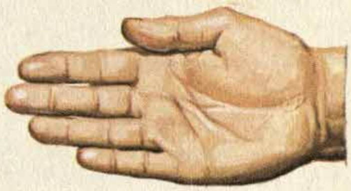
Both these pets eat plant food—sunflower seeds, wheat, cracked corn, oats, and scraps of vegetables and fruits. They hold their food with their front feet like squirrels. Hamsters have pockets in their cheeks just as chipmunks do. A hamster may stuff its cheek pockets so full of food that it looks as if it had mumps. Gerbils do not have cheek pouches. But they are sometimes greedy. They seem never to know when to stop eating sunflower seeds.

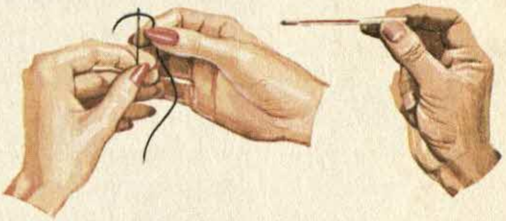
Both hamsters and gerbils are clean and orderly. A wire cage with shredded paper for a nest, containers for food and water, and an exercise wheel makes a good home for either of these two pets.

These little animals multiply fast. A female hamster or gerbil is ready to have babies when she is only three or four months old. The babies can look after themselves after about three weeks. (See RODENTS.)

HAND In the days of our caveman ancestors it did not seem that man had much of a chance to survive. He was not nearly as big or as strong as the giant cave bears and some of his other animal enemies. But he managed to hold his own. Today man is ruler of the earth.





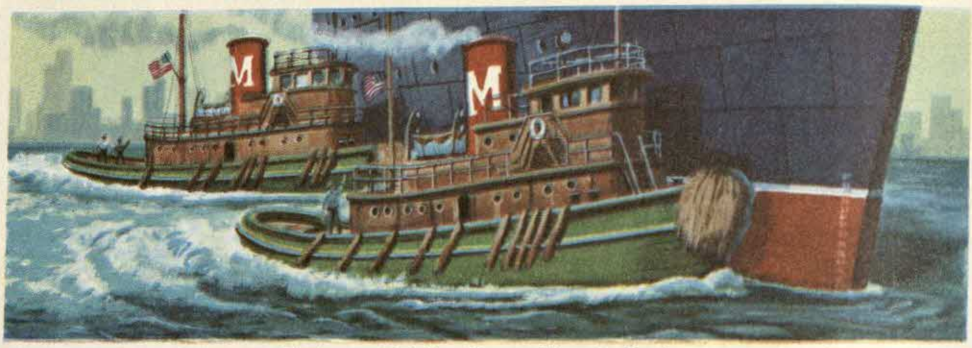


We have been able to win out partly because we have a better brain than any other animal, and partly because we have good hands. With his brain early man could invent weapons for fighting, tools for building, and machines for helping him raise crops. With his hands early man could make and use the weapons and tools and machines he invented.

Many animals use their front feet as hands at times. Squirrels hold nuts as they eat them. Kangaroos can be taught to box. Kittens will play with a ball with their front paws. Apes have hands very much like ours. But no other animals use their hands as well as we do.

Each of our hands has four fingers and a long thumb. The long thumb is important. It can push in the opposite direction from the fingers and thus help us hold things tight. Many little muscles move our fingers and thumbs. They make it possible for us to do such things as sewing, writing, and piano playing.

With the ends of our fingers we can tell whether what we touch is hot or cold, rough or smooth, hard or soft. Our fingertips are very sensitive. Fortunately, we have nails that help protect them and that add to their usefulness. (See FINGERPRINTS; NAILS AND CLAWS.)

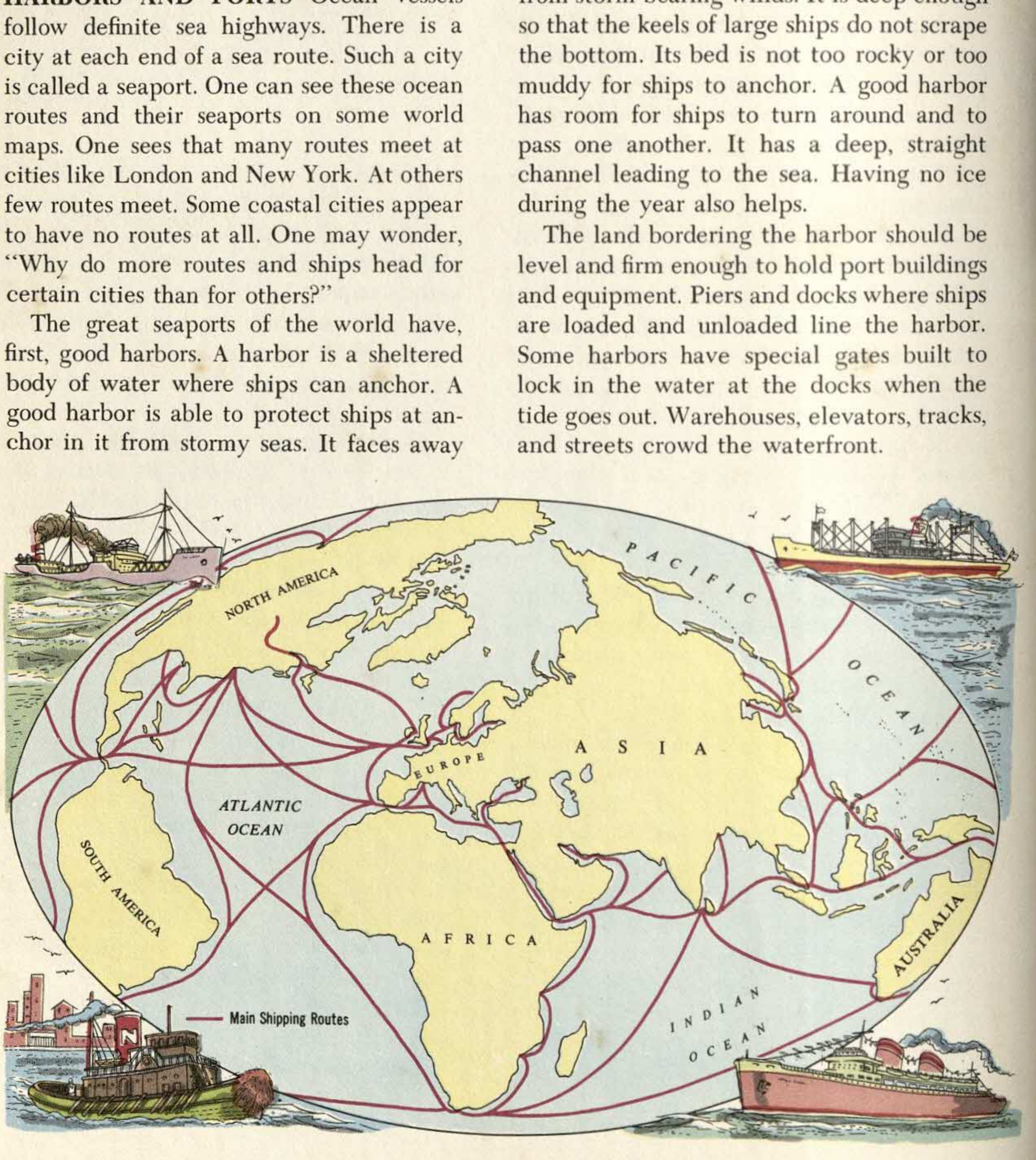


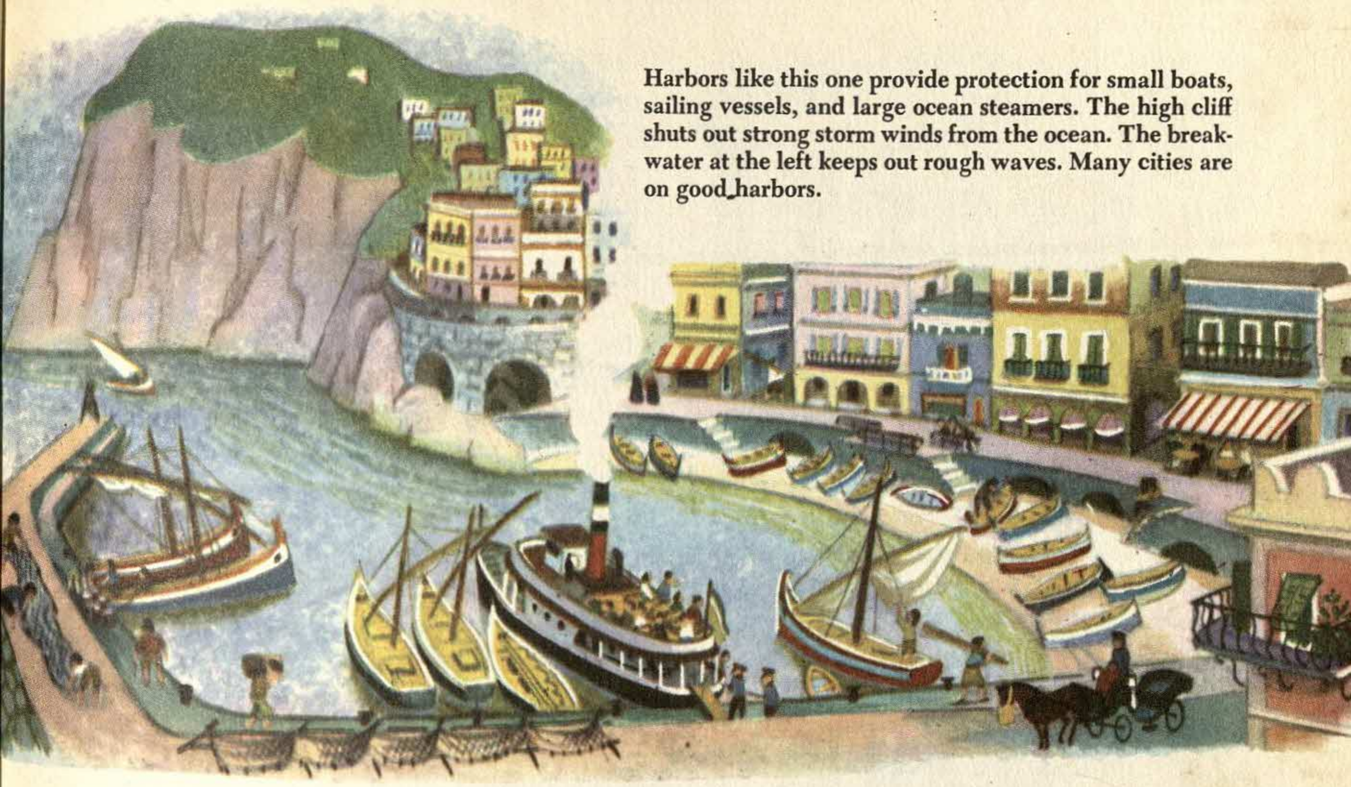
Tugboats Guiding Ocean Liner to Dock

HARBORS AND PORTS Ocean vessels follow definite sea highways. There is a city at each end of a sea route. Such a city is called a seaport. One can see these ocean routes and their seaports on some world maps. One sees that many routes meet at cities like London and New York. At others few routes meet. Some coastal cities appear to have no routes at all. One may wonder, "Why do more routes and ships head for certain cities than for others?"

The great seaports of the world have, first, good harbors. A harbor is a sheltered body of water where ships can anchor. A good harbor is able to protect ships at anchor in it from stormy seas. It faces away from storm-bearing winds. It is deep enough so that the keels of large ships do not scrape the bottom. Its bed is not too rocky or too muddy for ships to anchor. A good harbor has room for ships to turn around and to pass one another. It has a deep, straight channel leading to the sea. Having no ice during the year also helps.

The land bordering the harbor should be level and firm enough to hold port buildings and equipment. Piers and docks where ships are loaded and unloaded line the harbor. Some harbors have special gates built to lock in the water at the docks when the tide goes out. Warehouses, elevators, tracks, and streets crowd the waterfront.





Harbors like this one provide protection for small boats, sailing vessels, and large ocean steamers. The high cliff shuts out strong storm winds from the ocean. The breakwater at the left keeps out rough waves. Many cities are on good harbors.

Even good harbors differ from one another. The harbor of Rio de Janeiro is a wide bay protected by land on three sides. In some places deep, roomy river mouths called estuaries furnish good harbors. Such are the harbors of New York, Philadelphia, London, Hamburg, and Shanghai. If the port city is up the river some distance from the sea, like London, ocean vessels can carry their goods far inland before docking. This is often an advantage, because most water transportation costs less than rail or highway hauling.

Some good harbors are made by nature, but men must continually keep the channels deep and straight by dredging out sand and mud. Some harbors are largely or entirely man-made. Los Angeles' San Pedro Harbor is mostly man-made. Long concrete breakwaters had to be built for it.

Most of the world's largest cities are seaports. But a good harbor alone is not enough to make a city a great seaport. A great port must have, second, a backcountry where many busy people are producing goods for export and where there are thousands of people able to buy goods brought in from foreign ports.

A great seaport must have, third, good connections with its backcountry by means of railroads, highways, airways, or rivers. New York leads all Atlantic ports partly because of its unsurpassed land, water, and air connections with the rich interior of the country.

Not all ports are near the sea. Many cities on good lake harbors have become busy ports. A number of Great Lakes ports such as Chicago, Milwaukee, and Duluth are on harbors at the mouths of rivers. The opening of the St. Lawrence Seaway made these great lake ports far inland into seaports as well.

There are also river ports that serve river traffic. Duisburg, Germany, is such a port on the Rhine. Since river ports are not on harbors, the river channel must be made and kept wide enough for riverboats or barges to dock.

Harbors and ports play an important part in bringing people and products together. (See CITIES; RIVERS.)

HARMONICA Two hundred years ago some of the great composers were writing music for a new instrument which Benjamin Franklin had improved and named the harmonica. It was made of glass bowls mounted on a long rod that spun round and round. A player made music by holding his fingers on the rims of the spinning bowls.

The harmonica of today is not at all the same. Other names for the kind now used are mouth organ and French harp. The player, by sucking and blowing air into his harmonica, makes thin strips of metal called reeds move back and forth, or vibrate. The moving reeds produce the sound.

The harmonica of the kind used today was first made in Germany in 1821. It quickly became popular in Europe and in the United States. At first it was called an "aeolina" after the Greek god of the winds.

The harmonica is easy to play. There are harmonica bands in many schools.

HARRIS, JOEL CHANDLER (1848–1908) Some stories that are made up sound so real that it is hard to believe they are not true. The wonderful tales of Uncle Remus, by Joel Chandler Harris, are stories of this kind, even though they are about animals that can talk.

Harris was born in the small Georgia town of Eatonton. As a boy he was always fond of games and of animals. But often he liked to sit quietly and listen to people talk. He had a very good memory for how people talked and what they said.

When he was still a boy, Joel started to work on a new weekly paper—*The Countryman*—as a printer's helper. The publisher, Joseph Addison Turner, liked Joel and took the boy to live on his plantation. Life on the plantation did much to shape the boy's future. Here were many good books to read. When Joel wanted to write, Turner helped him. When he was not busy, Joel could go to the slave cabins and listen to the Negroes tell stories.

In 1876 Harris began working on the *Atlanta Constitution,* and it was in this newspaper that his first Uncle Remus stories appeared. They were based on the stories he had heard as a child. The stories soon made Harris famous throughout much of the world.

One of the best-liked Uncle Remus stories is "Tar-Baby." It tells of how Brer Fox caught Brer Rabbit one day with a sticky tar-baby. At the end, Brer Rabbit outsmarted the fox and got away. Many books of Uncle Remus stories have been published. The titles of some of them are *Nights with Uncle Remus*, *Uncle Remus and Brer Rabbit*, and *Uncle Remus and His Friends*. (See AMERICAN WRITERS.)

HARUN AL-RASHID (764–809) In many stories of the *Arabian Nights* Harun al-Rashid is the hero. Aladdin and Sinbad and the other heroes in the *Arabian Nights* were make-believe people. But Harun al-Rashid was a real person. He was the caliph, or prince, of Baghdad at the same time that Charlemagne ruled in Europe.

Baghdad is a city in the land now called Iraq. It has had a long, long history. Perhaps the brightest time in all its history was the reign of Harun al-Rashid.

As the caliph of Baghdad, Harun al-Rashid ruled not only over the city but also over the eastern Moslem empire. The caliph did not do much about affairs of state. He left them mostly to his vizier, whose name was Yahya. Harun al-Rashid himself was more interested in making Baghdad a center of art and learning. He was a scholar and a poet, and he invited other scholars and poets to his court. He also invited musicians and storytellers. The stories about him in the *Arabian Nights* were made up by these storytellers.

In many of the stories Harun al-Rashid put on a disguise and went out at night among his people. He found out a great deal about what his subjects were doing and saying. Even if the stories are entirely made up, they are fun to read, and they help us remember the name of a famous ruler. (See ARABIAN NIGHTS; IRAQ; MOORS.)

HARVEST MOON North of the equator fall begins late in September. This is the time when many crops of northern lands are ready for harvest. The full moon that occurs nearest the beginning of fall is called the harvest moon. The harvest moon rises at about the same time for several nights in a row. Its bright light lets farmers work in their fields at harvesting their crops long after the sun has gone down.

HARVEY, WILLIAM (1578–1657) Some 370 years ago William Harvey, a young Englishman, went to the University of Padua in Italy to study medicine. At that time doctors had strange notions about the work of the heart and the movement of blood through the body. They thought that the blood moved backward and forward like the ebb and flow of the tides. They thought that one kind of blood came from the liver and that it flowed to the right side of the heart, to the lungs, and then to the rest of the body through the veins. From the left side of the heart, they believed, came another kind of blood. This blood flowed to the rest of the body through the arteries.

Another wrong idea was that blood could pass directly from the right side of the heart to the left side. How it did was something of a mystery, since there is a thick wall between the two sides. But Galen, a famous doctor of ancient Greece, had taught that there were tiny holes in the wall for the blood to get through. Even in Harvey's time no doctors liked to deny the truth of anything Galen had said.

Harvey wondered about all these ideas when they were taught to him. He decided to find out for himself how blood moves.

When Harvey finished his work at the university, he returned to England and became a successful doctor. Before long he was appointed court physician to King James I, and later to Charles I.

For many years Harvey studied the work of the heart and the flow of the blood by experimenting with animals. He studied and made careful notes about the heart and blood movements of dogs and pigs, fish and frogs, and of little chickens growing inside eggs. He studied his patients, too. Harvey also learned a great deal by doing autopsies. Not till he was sure he had discovered the truth about the circulation of the blood did he publish what he had found.

The book he wrote, although it is now almost 350 years old, is still worth reading. In it Harvey correctly describes the circulation of the blood. He was the very first

person to do so. The book was written in Latin, the language used in all learned works of the time. The Latin name of Harvey's book, *Exercitatio anatomica de motu cordis et sanguinis in animalibus,* means "an anatomical study of the movement of the heart and blood in animals."

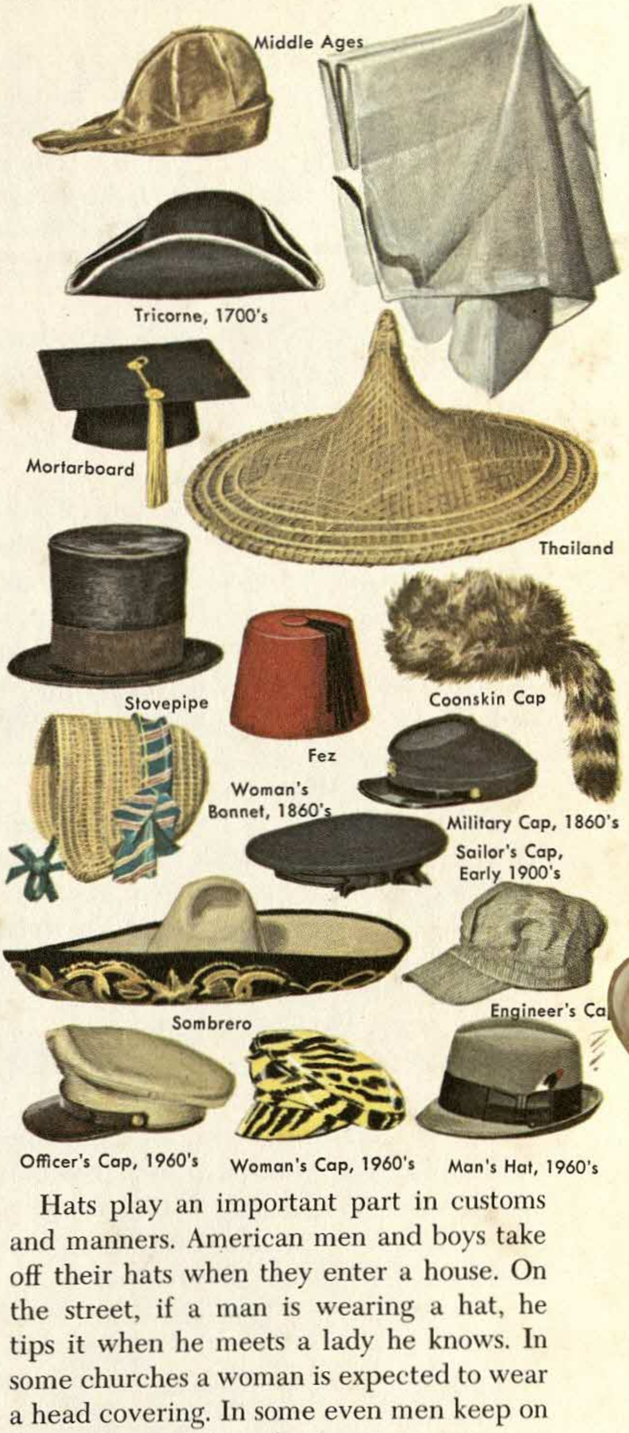
Harvey's discoveries were not accepted at once by the other physicians of his time. Many people decided that he was crazy and would not trust him as their doctor. Before his death, however, most people knew that he was right. Today he is considered one of the greatest scientists of all time. (See BLOOD; HEART.)

HATS AND CAPS A whole book could easily be filled with pictures of kinds of hats and caps that have been worn by different groups of people at different times. There is room here for only a few.

People wear hats or caps for two main reasons. One is to protect the head from cold or sun or storm. The other is as a decoration to fit in with the fashions or customs of the time. In many countries more and more people are now going bareheaded even in cold weather. Hatmaking, however, is still an important kind of work. Many women and girls always have several hats, and many men and boys have more than one. Besides, hats and caps are a part of many uniforms. As a part of his uniform, for instance, every fireman, policeman, soldier, and sailor has a hat or cap.

Fur hats, of course, are usually worn only in lands with cold winters. Fur is a good protection from cold. Broad-brimmed hats with tall crowns are most likely to be worn in regions where the sun is bright. The wide brim provides shade for the wearer's face. The air in the tall crown helps shut off the sun's heat.

Some kinds of hats are worn only on special occasions. A man, for instance, would never wear a silk top hat to a football game. But he might wear one to a wedding or some other formal occasion.



Hats play an important part in customs and manners. American men and boys take off their hats when they enter a house. On the street, if a man is wearing a hat, he tips it when he meets a lady he knows. In some churches a woman is expected to wear a head covering. In some even men keep on their hats as a sign of respect.

In many parts of the world hats change very little as the years go by. In others a hat that is fashionable one year may be old-fashioned the next. Of course, the hats that go out of fashion fastest are the ones that are worn chiefly for decoration. (See CLOTHING; ETIQUETTE.)

HAWAII In 1959 Hawaii became the 50th state. It is made up of a chain of about 25 islands in the middle of the Pacific Ocean. The map shows the principal islands. The others stretch westward from Niihau for hundreds of miles. Those the map does not show are all very small. Most of them have no people.

The state gets its name from the island of Hawaii, the largest island in the group. But even this island is not large. Only three states—Rhode Island, Delaware, and Connecticut—are smaller than Hawaii.

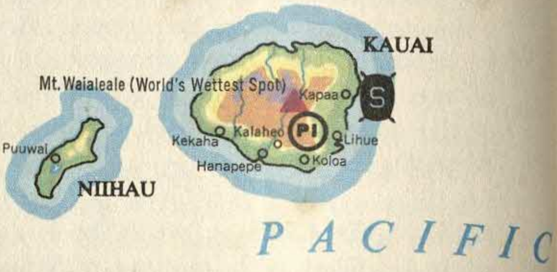
The islands are chiefly the tops of volcanoes that rise several miles from the floor of the sea. They have been made larger by reefs built by the tiny animals called corals. The most famous volcanoes of Hawaii are Mauna Loa, the largest mountain in the world, and Kilauea. Kilauea is on the slope of Mauna Loa. From time to time floods of lava pour from it.

Although Hawaii is the largest island, it is not the most thickly settled. Oahu has many more people. Honolulu, the capital and by far the largest city in the state, is on Oahu. The great naval base of Pearl Harbor is there, too.

Honolulu is more than 2,400 miles from the coast of California. When the fastest way of traveling to the islands was by boat, Honolulu was several days from California. Now with jet planes it is only five hours away. Because of the change of time, a jet can leave San Francisco at noon and be in Honolulu by midafternoon.

Hawaii is the farthest south of the 50 states. All year round the climate is pleasant for bathing, boating, and surfboard riding. Ocean breezes keep the temperature from climbing uncomfortably high. The climate is so pleasant that the islands are sometimes called the "Paradise of the Pacific." The climate and the beautiful scenery bring hundreds of thousands of visitors to the islands every year. Honolulu has excellent hotels, many close to the famous beach of Waikiki. "Aloha State," the state's nickname, comes from the Hawaiian greeting and farewell, aloha.

Flowers are in bloom all through the year. On the streets of Honolulu garlands of flowers, called leis, worn by tourists and islanders alike, are always for sale. Some of the prettiest are made of small orchids. Many of the orchids are flown in from Hawaii, the "orchid island."



Most of the world's pineapples come from Hawaii. Many of the people of the state earn their living working on pineapple plantations. Many others work in factories where pineapples are canned. Lanai is the "pineapple island." It is almost covered by one huge pineapple plantation.

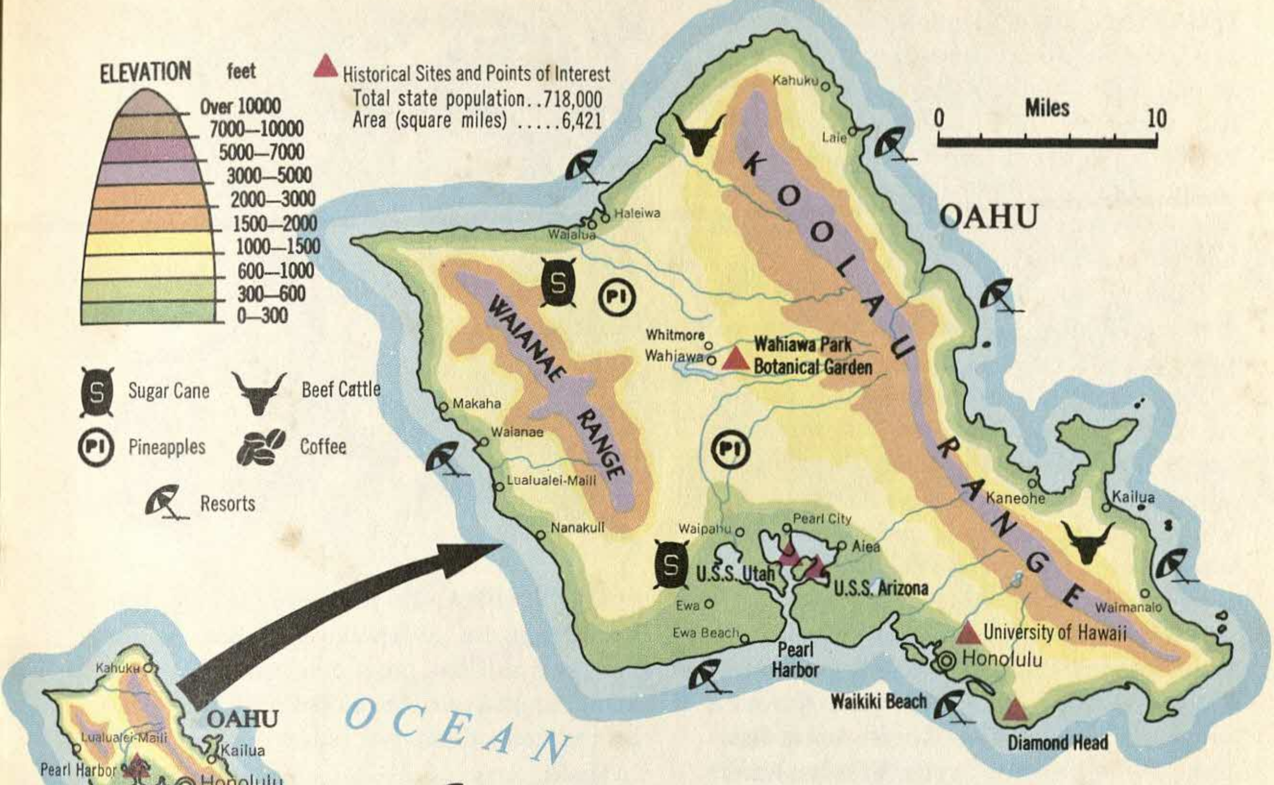
Although pineapples are Hawaii's best-known crop, sugar is its most important one. Some coffee is grown. And there are flower farms which ship flowers to cities in many parts of the world.

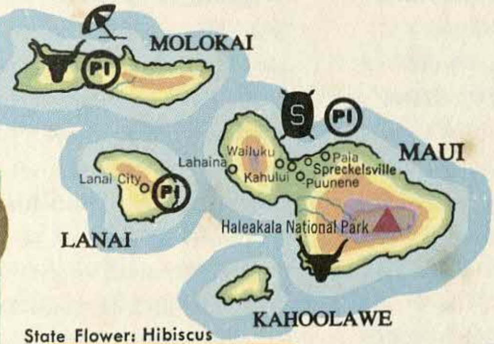
There are also big cattle ranches. The Parker ranch on Hawaii is one of the largest cattle ranches in the United States.

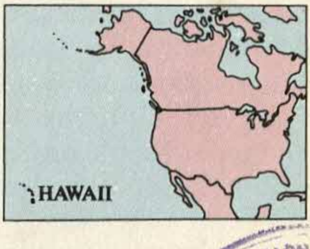
Hawaii has a mixture of peoples. The first inhabitants were Polynesians. But a hundred years or so ago people began coming from China, Japan, the United States, and other places, too. Many islanders of today have mixed ancestry. Hawaii is the melting pot of the Pacific.

Before 1898 the Hawaiian Islands were a country by themselves. For most of their history they were ruled by a king or queen. The most famous ruler was King Kamehameha. The last was Queen Liliuokalani.

In 1900 the islands were made a United States territory. They had to wait more than 50 years to become the 50th state.

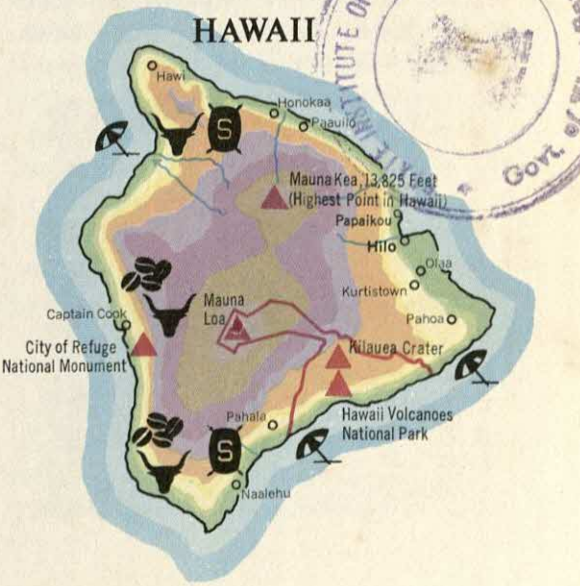






State Flower: Hibiscus

State Bird: Nene


HAWAII
Hawi
Honokaa
Paauilo
Mauna Kea 13,825 Feet (Highest Point in Hawaii)
Papaikou
Hilo
Olaa
Kurtistown
Pahoa
Mauna Loa
Kilauea Crater
Captain Cook
City of Refuge National Monument
Hawaii Volcanoes National Park
Pahala
Naalehu

INSTITUTE OF EDUCATION * Govt. of West Bengal

Surfer

Diamond Head

Casting a Net

HAWKING The two knights in the picture are going hunting. They do not have guns of any kind. In the days of knights, guns had not been invented. Instead of guns they have hawks. These hawks are trained to fly after small animals and kill them. The hawk is really both the knight's gun and his hunting dog.

Hunting with a hawk is called hawking. It is also called falconry. "Falcon" is another name for hawks of certain kinds.

Hawking is a very old sport. A picture made in Assyria 700 years before Christ shows a falcon on the wrist of a hunter. All during the Middle Ages hawking was a favorite sport of kings and nobles. Then interest in it faded. Now this ancient sport is becoming popular again.

A person interested in hawking has to train his hawk himself. But first he must get one. A good place to get one is from a nest of young hawks. These nests, however, are not easy to reach. Besides, hawks fight fiercely to protect their young.

A hunter who goes hawking wears a leather gauntlet on his wrist. His hawk's claws are very sharp. The hawk wears a hood to keep it from seeing an animal and flying after it before the hunter is ready. The hawk also wears leather bands called "jesses" on its legs. Above the jesses are two tiny bells. A leash is fastened to the jesses when the hawk is on its perch. The bells help the hunter keep track of the hawk. (See BIRDS OF PREY.)

HAYDN, FRANZ JOSEPH (1732-1809) The "Surprise Symphony" is one of the first symphonies boys and girls learn to know. It was written about 200 years ago by the great composer Haydn.

Haydn was born in a small town in Austria. His parents loved music, and Haydn as a boy heard good music in his home.

When he was only seven he became a choirboy in a great church in Vienna. He studied in the school of this church for several years. Then his voice changed, and he could no longer be a choirboy.

For the next eight or ten years Haydn's life was hard. He had almost no money, and he was often hungry and cold. But good fortune came at last. Haydn was made director of Austria's finest orchestra—the orchestra of Prince Esterházy. He directed this orchestra for 30 years.

During these 30 years Haydn became famous all over Europe for his own music. He wrote more than 100 symphonies, more than 80 quartets, more than 50 sonatas, 25 operas, 5 oratorios, and much other music. He is called the father of the symphony and the founder of the string quartet. Not only the "Surprise Symphony" but many others of his compositions have lived on. Many are played by our great orchestras today. (See COMPOSERS; ORCHESTRA.)

FOODS FOR GOOD HEALTH

HEALTH Good health is a great blessing. Everyone should do all he can to stay healthy. Being in good health means having both body and mind in good working order, free from disease and pain.

Good food, fresh air, exercise, good posture, plenty of rest, sunshine, pure water, comfortable clothing, cleanliness, and regular checkups with the doctor and dentist all help keep our body machines running as they should.

Food does many things for our bodies. It provides the materials for growing and for repairing worn-out parts. It gives us energy for work and play. It furnishes the "sparks" that keep all the parts of our bodies doing their work well. No one food gives us everything we need. We should eat foods of different kinds. Having enough to eat is not the same as having the right food.

Sleep is the best kind of rest. Growing children need more sleep than grown-ups. Children's bodies not only have to be repaired; they also have to grow. No one's body can grow bigger properly while he is working and playing and wearing it out.

Exercise makes muscles strong and helps us have good posture. It also makes blood rush through the body faster, carrying food and oxygen. Exercise in the fresh air and sunshine is especially good. Exercise should be fun, too. Healthy exercise that is fun helps keep us well mentally.

The water we drink helps wash away wastes formed inside our bodies. It also puts back the water we lose when we perspire. Our bodies are actually more than half water. We must drink about six glasses a day to replace what we lose.

We feel and look better if we are clean. A bath every day is a good rule. Brushing our teeth is part of keeping clean.

Clothing should be suited to the weather. On cold winter days clothes should keep in the body's heat. In hot summer weather clothes should let body heat escape. Loose clothing is better than tight clothing because it allows the wearer to move about more easily and does not interfere with the circulation of the blood.

One should not wait to get sick or have a toothache before going to the doctor or dentist. A checkup is a kind of "stitch in time." If something is found to be wrong, the doctor or dentist has a good chance of being able to make it right again.

Even if a person has very good health habits, he will probably be sick once in a while. He may get an illness caused by disease germs. He can get these germs by being with sick people. He can get them through impure milk or water or some other food. Or they can be carried to him by insects or other animals. Food spoiled by germs may make him sick. Living in a damp, dark, dirty house may also help make him sick. And if he works in a factory where proper safety precautions have not been taken, he may become sick from poisonous gases or harmful dust.

Today governments are doing a great deal to help keep people well. They provide safe water, sewage and garbage disposal, and parks and playgrounds. They try to see that houses and other buildings are safe for people to live or work in. They have health departments ready to fight any disease that might spread. Many are working on ways to clean up polluted lakes and streams and the polluted air of cities.

Governments also run clinics and hospitals to treat sick people. They carry on experiments to learn more about diseases, too. Since 1948 the World Health Organization, or WHO, of the United Nations, has been working for better health for all the people of the world.

Working for good health has made a big difference in how long people live. In the days of our caveman ancestors people lived an average of less than 25 years. Now the average in North America, Australia, and much of Europe is about 70 years. It has gone up more than 20 years just since the beginning of this century! (See AIR POLLUTION; BODY, HUMAN; FOODS; SLEEP; WATER POLLUTION.)

HEART "I love you with all my heart" is a common saying. "Stouthearted" means brave. "He has a good heart" is a way of saying he is kind. Once people thought our feelings of love, bravery, and kindness came from our hearts. Now we know better. But we still talk as if they did.

A person's heart is about the size and shape of his fist. It weighs somewhat less than a pound. A real heart does not look much like the hearts on valentines.

We do not feel with our hearts, but they are very important. Blood must be kept moving in our bodies every minute of our lives. It must carry food and oxygen to all parts of the body and take away waste materials. The blood travels through blood vessels of three kinds: arteries, veins, and capillaries. The heart keeps the blood moving.

The heart is really two pumps in one. One half of the heart makes blood flow to the lungs and back again. The other half sends the blood over the rest of the body.

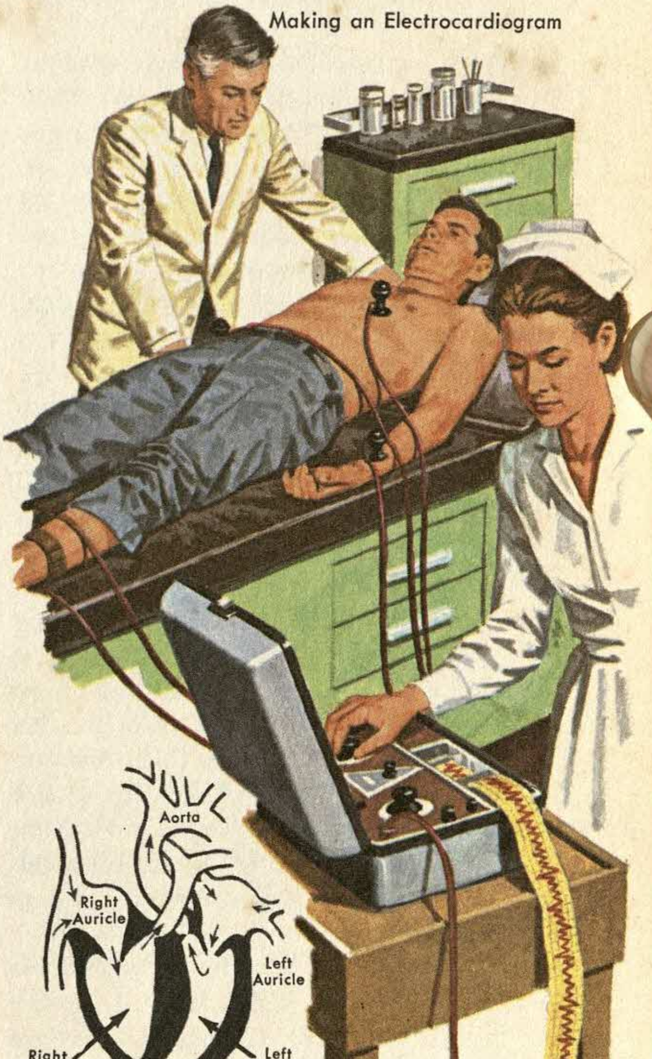
Each half of the heart has two rooms: an auricle and a ventricle. The auricle on the *left* side of the heart receives blood that has just come from the lungs. The *left* auricle sends the blood into the *left* ventricle. The left ventricle then squeezes the blood into a big artery called the aorta. The aorta has branches going all over the body. The blood flows from them into tiny capillaries. From the capillaries it flows into veins. They carry it to the *right* auricle. From there it goes to the *right* ventricle. The right ventricle sends it through arteries to the lungs. It flows through the capillaries in the lungs, then into veins and back to the heart to start over again.

There are valves in the heart. They keep the blood flowing the right way.

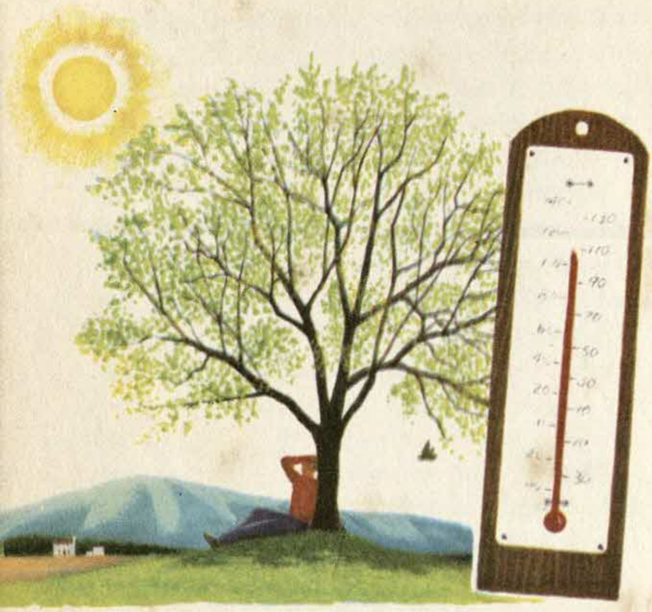
The walls of the heart are mostly muscle. The muscles of the heart never get a rest as the muscles in our arms and legs do. The pump must keep working. Every time the heart muscles contract and force the blood out into the arteries we say there is a heartbeat. The surge of blood at each heartbeat can be felt in the wrist. Counting these surges is called taking the pulse. The opening and closing of the valves in the heart make a noise that a doctor can hear with his stethoscope. Our hearts beat faster at some times than at others. But they always beat many times a minute—sometimes more than 100. Normally children's hearts beat from 80 to 100 times per minute.

An electrocardiograph is an instrument for making a record of how a heart is working. Such a record is called an electrocardiogram.

Many other animals have hearts. But only birds and mammals have hearts with four rooms. (See BLOOD; HARVEY.)


Making an Electrocardiogram

Heart



HEAT In ancient times people thought that heat was a material just as air is. They called it "caloric." When something got warm, they said, caloric flowed into it. When something cooled off, caloric flowed from it. Of course, they could not see caloric. But they could not see air either.

Now we know that heat is not a material. It does not take up any space. It does not weigh anything. It is a form of energy instead. Saying that heat is a form of energy means that it can be used to do work. When we see an automobile speeding down a road, we can be fairly sure that it is being driven by the heat of burning gasoline.

There are many ways of producing heat. Fire, friction, electricity, and the splitting of atoms are four of them. All our ways of producing heat, however, would not keep the earth warm enough for us to live on it if it were not for the sun. In the sun changes are going on that keep it so hot that we can hardly imagine how very hot it is. It has been heating the earth for billions of years and will keep on doing so for ages to come.

Heat travels much better through some materials than through others. It travels easily through metals. We say that they are good conductors of heat. Wool, asbestos, and still air are three of the many poor conductors of heat. We use poor conductors to shut heat in or to shut it out.

Currents in gases and liquids may carry heat from one place to another. Such currents are called convection currents.

The sun heats the earth by radiation. Rays given off by anything hot are changed to heat when they strike something which absorbs them.

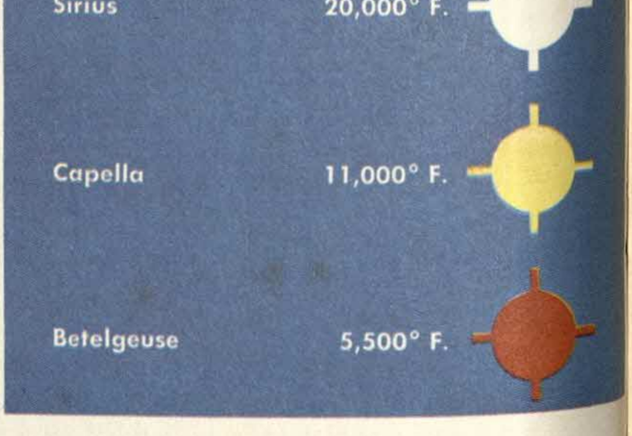
Most substances expand, or get bigger, when they are heated. Engineers must allow room for expansion when they build concrete roads and steel bridges.

Heat brings about many other changes in materials. Heating some solid substances makes them melt. Heating liquids makes them change to a vapor, or gas. Heat causes chemical changes, too.

Cold means absence of heat. We can cool something only by making heat travel out of it. In a refrigerator we do not put cold into the food. We take heat out.

Knowing how heat can be produced, how it travels, and what kinds of changes it brings about is important to all of us. (See ENERGY; FIRE; HEATING AND VENTILATION; SUN; THERMOMETER.)

Temperatures of Four Bright Stars



HEATING AND VENTILATION Many people live in parts of the world with cold winters. They are able to do so partly because they have learned to make warm clothing and partly because they have learned to heat their buildings. Most of the heating is done with fire.

The idea of heating with fire is very old. Thousands of years ago the cavemen were using fire for heating.

Probably the earliest way of heating a room was simply to build a fire in the middle of the room. Since the earliest floors were earth or rock, fires could be built on them safely.

The Romans worked out a way of heating all the rooms in their houses with one fire. The fire was built under the floor of a building. Smoke and hot air rose from the fire and were carried through flues in the walls over the whole building.

Heating all the rooms of a building from one source of heat is called central heating. After the days of the Romans, the idea of central heating was given up for 1,500 years. People went back to the idea of a fire in each room. But they found better ways of heating than simply having a bonfire on the floor.

Moving the fire from the center to one side of the room was a start toward a fireplace. At first there was only a passage in the wall above the fire to let out the smoke. But in time someone found a way of building a kind of hood to guide the smoke to the opening. At last real chimneys were built, and fireplaces came to look much as they do now. Many of the fireplaces in medieval castles were so large that they burned logs too big for one man to carry.

The first stoves were built at about the end of the Middle Ages. The ancient Egyptians used metal pans called braziers for carrying hot coals from place to place. But the idea of shutting fire up in stoves was slow in coming. Once people had the idea, stoves of many kinds were invented. Tile stoves became common in Europe. In 1744 Benjamin Franklin invented the Franklin stove, an iron jacket and grate that could be used either as a stove or a fireplace. For years Franklin stoves were popular throughout the United States.

In a central heating system, hot air, hot water, or steam is sent from a furnace through pipes into the rooms of a building. A fire in the furnace heats the air or the water in hot-air and hot-water furnaces. In steam systems it heats water so hot that it turns to steam. Coal or oil or gas may be burned in the furnace.

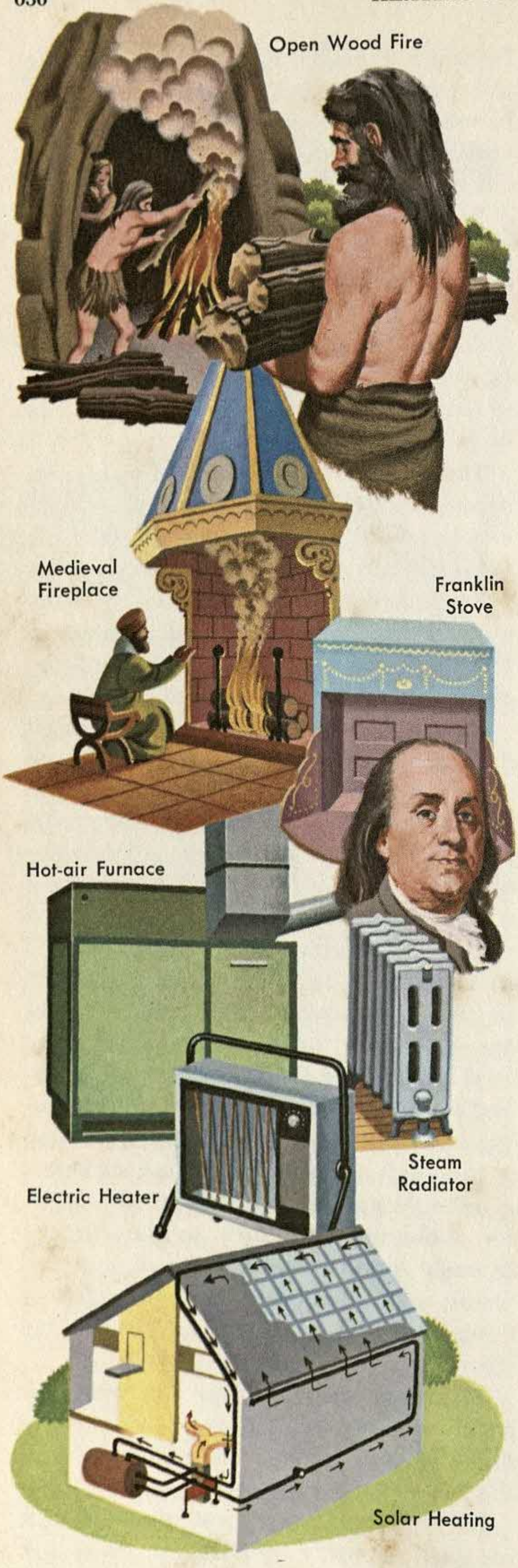
The simplest hot-air and hot-water furnaces work because air and water are lighter when they are hot than when they are cold. Hot air and hot water are constantly being pushed up from the furnace by cooler air and water. In more modern furnaces there are fans or pumps to help push the air or water through the pipes.

In a steam system steam forces itself through the pipes because steam takes up much more space than the water it comes from. Steam heats a building very well, because it is very hot as it leaves the boiler of a furnace. It also gives off a great deal of heat as it changes back to water. As a rule the temperature of steam is 212°F. In some steam heating systems, a vacuum device can be used to control the temperature at which the water boils. By doing so it controls the temperature of the steam and makes it easier to get just the temperature wanted in the rooms being heated.

In most hot-air systems the hot air enters a room through an opening called a register. Cold air goes back to the furnace through another register. Steam and hot water as a rule travel through radiators in each room of a building. Air heated over the radiators circulates in the room.

The steam and hot water may travel instead through pipes that are hidden in the floors or walls of each room. Heating in this way is called radiant heating.

Electric heaters can heat rooms. Panels carrying electric wiring may be built into



walls, too. Heating with such panels is another type of radiant heating.

Experiments are now being carried on with sun, or solar, heating. The picture shows one way of using the sun to heat a house. There are other ways. But a solar heating system is not suitable for regions where the winter sun is low in the sky.

An Eskimo igloo is a snug winter home. A tunnel protects the doorway from wind. If the igloo is lined with skins, one small oil lamp may give off all the heat needed. But not many people would want to trade our way of heating for the simple Eskimo way. For there is no way for the gas from the oil lamp to escape or for fresh air to come in. We think that it is just as important to keep the air in a room fresh and odorless as it is to keep it warm. Changing the air in a room is called ventilation.

People used to believe that stale air was likely to give people headaches chiefly because much of the oxygen had been used up and carbon dioxide had been formed in its place. Now scientists have found out that moisture and odors are more important than carbon dioxide in making air stale. They have found out, too, that even if no fresh air is brought into a room, circulating the air in the room is a help.

One way of ventilating a room is simply to open windows in it. Fans may be used to blow in fresh air and blow out stale air. Today heating systems and ventilating systems are often combined. When a hot-air system is used, for instance, air may be brought in from outdoors to be heated. In some ventilating systems the air is washed. In some it passes through filters. Such ways of ventilating are air-conditioning systems. Many people think of air conditioning as being for hot weather only. But keeping the air in a building free from dust and odors is important in cold weather, too. With good heating and ventilation we can have pleasant summer weather inside our houses all winter long. (See AIR CONDITIONING; FIRE; FUELS.)

HELICOPTER A helicopter can fly forward just as an airplane does. But it can do many things an airplane cannot do. It can fly straight up, straight down, backwards, or sideways. It can hover almost motionless over one spot and can take off or land on a very small field.

Helicopters do not have wings like those of airplanes. Instead, they have rotors made up of blades. The rotors serve as both wings and propellers. "Helicopter" comes from two Greek words meaning "spiral" and "wing." Because of their rotors helicopters are often called whirlybirds. Other nicknames are "choppers" and "eggbeaters."

The pictures show a few of the types of helicopters. Three, as you see, have big twin rotors. One has a single main rotor, and a small rotor on its tail. The small rotor acts as a rudder. Helicopters may have either piston or gas turbine engines.

Helicopter pilots make their craft go up or down by changing the tilt of the blades of the main rotors. They make them go forward, backwards, or sideways by tilting the rotors themselves.

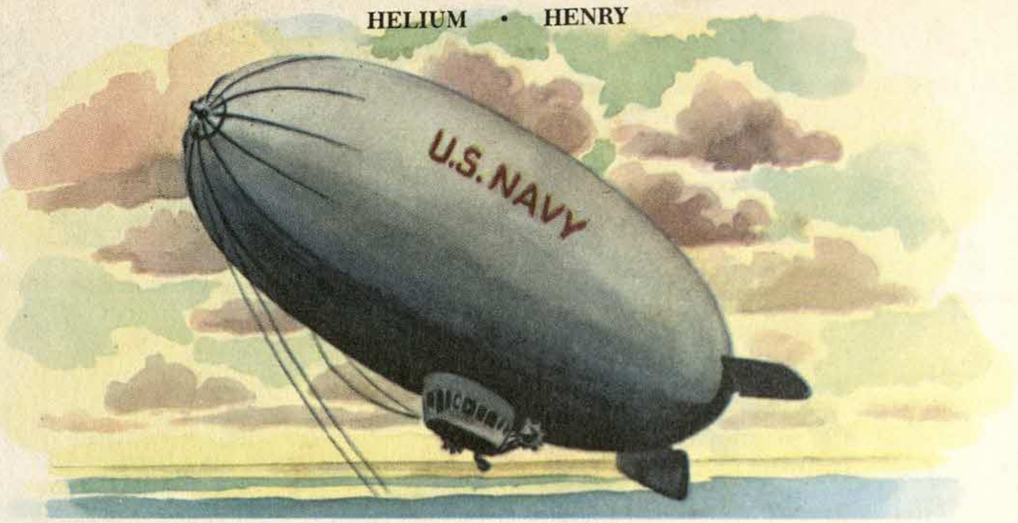
The idea of a helicopter is not new. The Italian genius Leonardo da Vinci planned one more than 400 years ago. He even built models that sometimes worked. But useful helicopters are much newer than airplanes. The first successful helicopter flights were made in the late 1930's.

Helicopters are helpful in many ways. Here are a few of the jobs they do:

Carry mail to and from airports.
Help guide traffic on crowded highways.
Carry passengers to airports.
Help forest rangers fight fires.
Spray forests, fields, and orchards.
Help take censuses of wild animals.
Rescue people trapped, lost, or wounded.
Carry troops to battle areas.
Act as "shoot and scoot" weapon carriers.
Pick up astronauts at sea.

Many helicopters land and take off from regular airports. There are also heliports built for helicopters only. One is on the top of the huge Pan-Am Building in New York City.

Although some of the newer helicopters are fast, they are not as fast as the fastest planes. They do not, moreover, ride as smoothly, and they are harder to handle. But year after year new uses for helicopters are found. (See AIRPLANES; VTOL.)



HELIUM Blimps like this one were important in World War II. They were filled with helium. Helium is a very light gas. Although not as light as hydrogen, it is much better for balloons because it will not burn. It is useful in other ways, too.

The name of this gas comes from the Greek word for sun. In 1868 scientists discovered helium in the sun. Nearly 30 years later they discovered it on the earth.

Helium is found in natural gas. Practically all the helium in the world is produced in the United States. The most important production plant is in Texas.

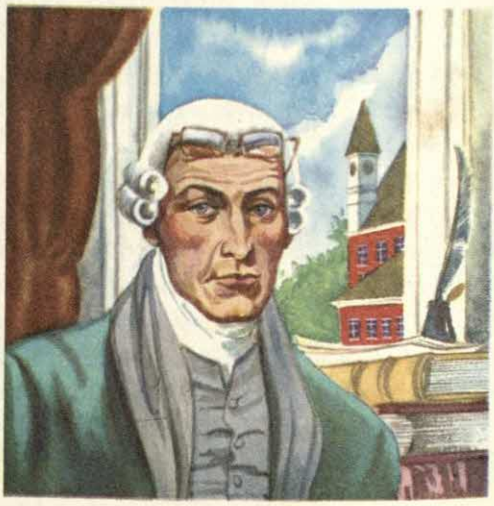
Although helium is rather scarce here on the earth, there is a great deal of it in the universe. All the billions of stars are made up mostly of helium and hydrogen. (See AQUANAUTS; BALLOONS.)

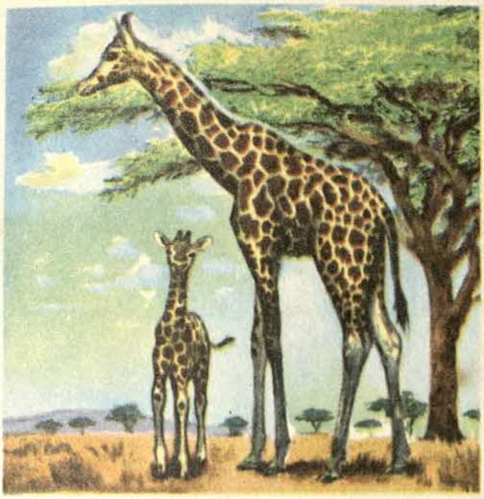
HENRY, PATRICK (1736–1799) Visitors to Richmond, Va., are often taken to see the church where Patrick Henry worshiped and to places where he made some of his famous speeches. Richmond is proud of Patrick Henry because he was a great orator and a great patriot.

In one of his most famous speeches, Henry shouted, "But as for me, give me liberty or give me death." This speech was made nearly 200 years ago, in the days of the 13 colonies. Patrick Henry was urging the colonies to fight for freedom from England's rule. Not long afterward the colonies fought the Revolutionary War and became a free country.

Patrick Henry was born in Virginia. As a boy he was not interested in school. He went to work as soon as he was old enough. First he tried keeping a store but was not a success. Next he tried being a farmer but failed at this, too. Then he decided to study law. He liked it so much that he became a lawyer in a very short time.

From then on he took a great interest in government. His speeches helped bring about the Revolution. Afterward he was the governor of Virginia for several terms. He served many terms in the Virginia legislature, too. He can be thanked for some good amendments to the constitution of the new country he had helped found. Patrick Henry is on every list of American patriots. (See PATRIOTS.)





Giraffe, a Large Herbivorous Mammal

HERBIVOROUS ANIMALS Animals that eat nothing but plants are called herbivorous animals. All animals get their food from plants. But some get it by eating animals that eat plants. The herbivorous animals eat the plants themselves.

In every place where there are any animals at all there must be some plant eaters. If there weren't, there would be no food for the meat eaters.

There are thousands and thousands of kinds of herbivorous animals. Some are small, some are medium-sized, and some are large. Treehoppers and butterflies and water fleas are herbivorous. So are rabbits and squirrels and many fishes. Camels, giraffes, and zebras are herbivorous, too. There are a great many others besides.

Some animals are herbivorous for only a part of their lives. Frogs and toads eat plants when they are tadpoles. They are meat eaters after they grow up.

Plant eaters have one big advantage over meat eaters. Their food cannot run away from them. They do not have to be such active animals. On the other hand, most plant food is harder to digest than meat. Besides, a plant eater must eat a great deal of food to get all the nourishment it has to have. A horse out on pasture has to eat grass most of the day, while a cat can eat enough meat in a few minutes to last it for hours. (See CARNIVOROUS ANIMALS; FORAGE CROPS; HOOFED ANIMALS; OMNIVOROUS ANIMALS.)

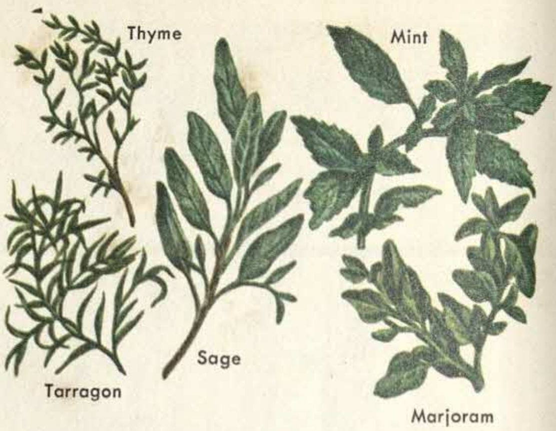
Buffalo Treehopper

Cottontail

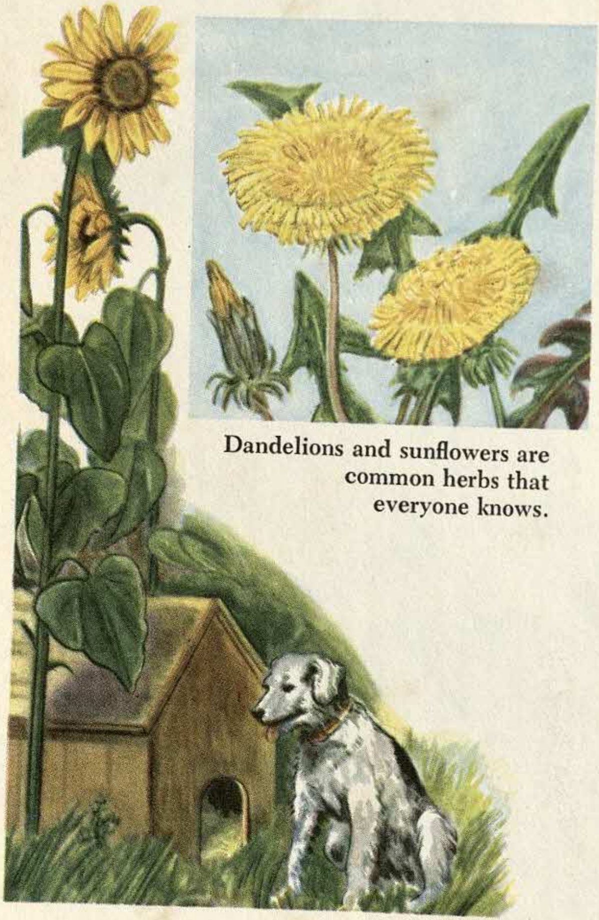
HERBS Trees have woody stems. So do bushes, or shrubs. But there are many green plants that do not have any wood in their stems. These plants are called herbs.

Herbs grow in different ways. Some, like dandelions, are low-growing; they never get far above the ground. Others, like sunflowers, grow tall. Still others are vines.

The stems of herbs have a great deal of water in them. Because of this water, they freeze when cold weather comes. But, although the stems may die down to the ground in the winter, some herbs are perennials—they are able to live on year after year. They live on underground and send up new stems and leaves in the spring. Some of these herbs have underground stems that stay alive during cold weather; some have big roots; some have bulbs.



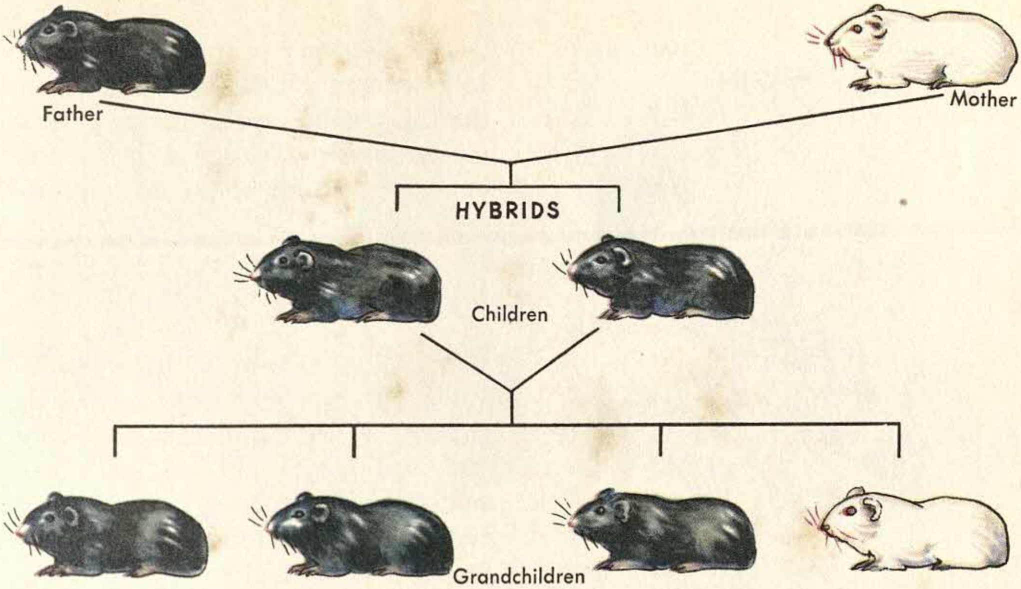
The word "herb" has another meaning to many people. It means plants used to give special flavors to foods. The picture above shows five herbs of this kind. Sage is much used in poultry stuffing. Tarragon we use to flavor pickles and vinegar. Thyme and marjoram are often added to sauces, soups, and stews. Mint sauce is good with lamb. Mint is also a popular flavoring for chewing gum. Whole gardens of herbs for flavoring used to be common. A number of perfumes, too, have long been made from the herbs of herb gardens.


Dandelions and sunflowers are common herbs that everyone knows.

"Herb" has still another meaning. It may mean a plant from which medicine is made. There used to be many herb doctors. We still get some medicines from herbs. One is ephedrine. Doctors in China were using the herb it comes from 4,000 years ago. (See CHEWING GUM; COOKING; DRUGS; FLAVORING; GINSENG.)

HEREDITY No one expects to raise a rosebush by planting a hollyhock seed. No one expects a bluebird's eggs to hatch into peacocks. But why is it that young plants and animals are always much like the plants and animals that produced them? The answer is that every living thing inherits, or gets from its ancestors, a great deal. It may inherit ways of doing things as well as such things as size and shape and color. A Baltimore oriole, for example, does not have to be taught how to build a wonderful hanging nest.

Heredity is another name for inheriting. Scientists know now that living things inherit their characteristics because of very,



very tiny particles called genes. They are a part of the cells living things are made of. An apple tree raised from a branch of another apple tree will be very, very much like the tree it came from if it has the same chance to grow. Its genes are just like those in the parent tree. Sponges are simple animals. A new sponge may grow from a bit broken off from another sponge. One that does will be almost exactly like the parent sponge. Its genes are the same.

Most plants and animals, however, have two parents. They get some of their genes from one of these parents and some from the other. The seed from a hollyhock with pink flowers would certainly not produce a rose, but it might produce a plant with white flowers. A long-haired mother cat might well have a short-haired kitten.

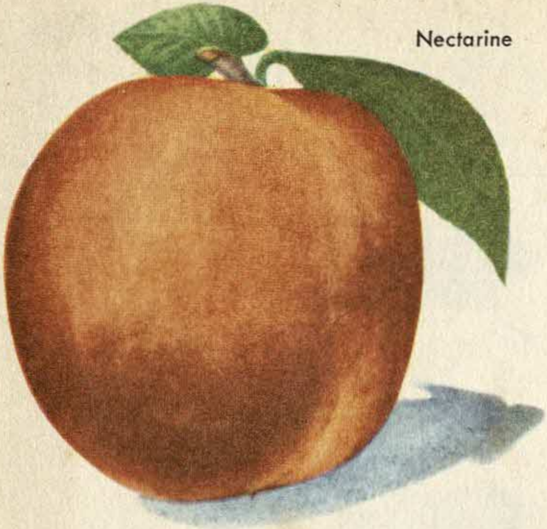
Scientists who study heredity have done much experimenting with crossing plants and animals that are quite different in certain ways. The man who started scientists to experimenting with heredity was an Austrian monk, Gregor Mendel. He found out a great deal about heredity by experimenting with the plants in the monastery garden. He worked out some laws about heredity that are called Mendel's laws.

The chart above shows what to expect when a purebred white guinea pig is mated with a purebred black one. All the guinea pigs they produce are black. They get genes for blackness from one parent and genes for whiteness from the other. But the genes for blackness have more effect than those for whiteness have. If, however, two guinea pigs of this generation are mated, they pass on genes for both blackness and whiteness. Roughly one out of every four of their offspring will get only genes for whiteness and will be white.

If a plant or animal inherits two different genes for some characteristic, one may not have any more effect than the other. If a red cow and a white bull are mated, the calves are likely to be roan—halfway between red and white.

Knowing something about heredity has helped scientists develop plants and animals that suit our purposes better than those we had before. It has helped, for instance, to develop hybrid corn, which has produced much bigger yields and much better corn than any earlier corn.

Once in a while a plant or animal may show a decided change—a change that cannot be explained by studying the ancestors of the plant or animal. A plant raised from the seed of a vine, for instance, may be a dwarf bush instead. And it may pass on dwarfness to the plants raised from its seeds.



New plants and animals that show such sudden changes are called sports, or mutants. Scientists explain them by saying that something happened to bring about a change in the genes.

Not many sports, or mutants, are changed in desirable ways. But a few are. With the hope of speeding up the improving of the plants we raise, scientists are experimenting with ways of bringing about changes in genes. They are using, for instance, various chemicals and kinds of radiation. But most of the changes are not for the better. Many thousands of the mutants are thrown away.

Scientists cannot experiment with people as freely as they do with many other living things. But they are finding out more and more about what can be inherited and what cannot be.

Scientists know, for instance, that a carpenter cannot pass on to his children his skill as a carpenter. The children have to develop that skill for themselves if they, too, want to be carpenters. But the carpenter's children may inherit well-built hands that will make learning to use tools easy. The child of an astronomy professor cannot inherit what his father knows about the stars, but he can inherit the kind of mind that will let him learn about the stars. A child cannot inherit tuberculosis, but he can inherit a tendency to get the disease if germs enter his body.

The discovery of how atoms can be split to get energy is called by many scientists the most important single step in science in the 20th century. The discoveries that have been made about heredity rank almost as high. (See ANIMAL BREEDING; EVOLUTION; HYBRIDS; MENDEL; PLANT BREEDING; TWINS.)

HIBERNATION Most living things have a way of escaping long periods of cold weather. Plants drop their leaves and rest. Many birds, a few insects, and some other animals migrate. People put on warmer clothes, start the furnace to working, and, for much of what they eat, depend on food that has been stored or brought in from warmer places. Some animals hibernate. Hibernation is often called winter sleep.

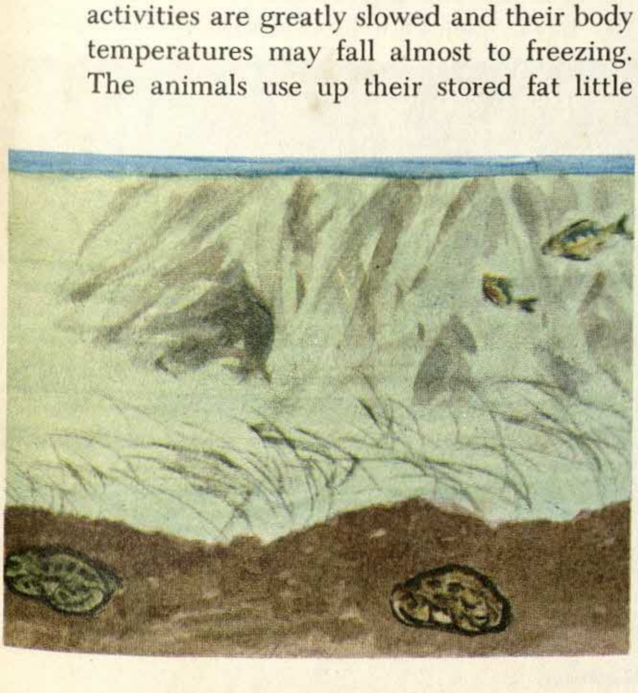
Scientists believe that most hibernators do so chiefly because of falling temperatures. Most hibernators are cold-blooded. When the surrounding temperature falls, the temperature of cold-blooded animals falls also. Cold-blooded animals are only half-alive during winter.

Amphibians burrow in the mud, among sticks and stones, and in rotting tree trunks. A hibernating frog appears to be dead. There is no air in its lungs, and its heartbeat is too slow to be detected. The frog remains in this half-alive state until spring.

Bear Wintering in Cave

Among the other cold-blooded animals that hibernate are many butterflies and other insects, land snails, and reptiles.

Some mammals hibernate, too. Low temperature is not of itself the reason for mammal hibernation, since mammals are warm-blooded. Mammals that hibernate do so because of the lack of food in winter. These animals store up fat in the summer and then curl up in a burrow or den for the winter. Some even hide food or take it into the den with them. They wake up occasionally in the winter to eat. All living activities are greatly slowed and their body temperatures may fall almost to freezing. The animals use up their stored fat little by little. Ground squirrels in cold regions may enter their burrows sleek and fat in the fall and come out in the spring weighing barely a fifth as much as when they went in.

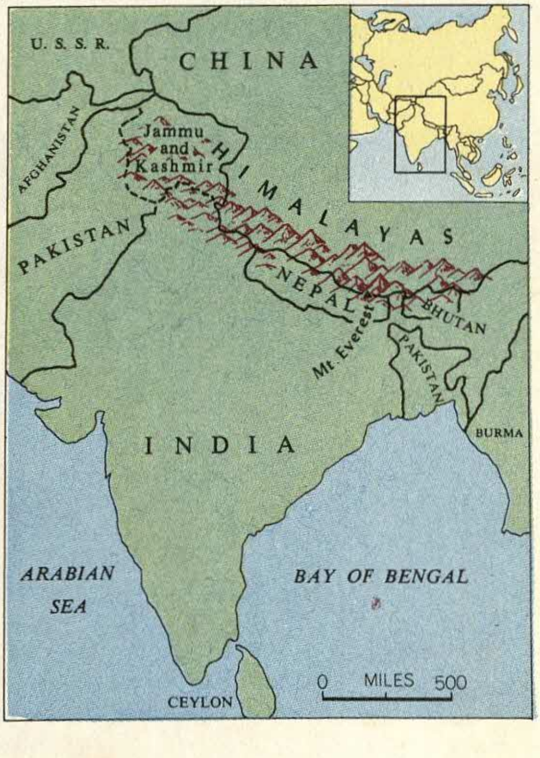


Many mammals sleep through most of the winter—bears, skunks, chipmunks, opossums, and others besides—but are not true hibernators. Their bodies stay warm.

HIMALAYAS In the whole world there are only 13 mountains more than five miles high. They are all in the Himalayas. Mount Everest is the highest of them. It measures just over 29,000 ft.

Until 1953 no one had ever been able to climb Mount Everest although many had tried. On May 29 of that year Edmund Hillary of New Zealand and Tenzing Norkay of Nepal reached the top.

Mount Kanchenjunga is the most beautiful of the great Himalayan peaks. It is about 900 feet lower than Everest. A British expedition led by Charles Evans climbed to within a few feet of the top of Kanchenjunga in 1955. They did not climb the



last few feet because the people of Sikkim hold the summit sacred.

The Himalayas are in central Asia. They form a 1,500-mile-long wall between Tibet and India. For hundreds of miles this wall cannot be crossed on land. Dozens of the peaks are over four miles high. During World War II the Himalayas were called "the Hump." Planes flew over the Hump to carry supplies from India to China.

Some mountains are playgrounds. But not the Himalayas. The southern slopes are very rainy, and dense forests grow on them. The northern slopes are bleak and bare. In winter the weather is bitter cold. "Himalaya" means "home of snow."

In a story about the Himalayas called *Lost Horizon*, there was a valley named Shangri-La. It was a beautiful valley in the midst of the bleak, snow-covered mountains. Shangri-La has now come to mean a lovely place hidden away in some distant part of the world.

The Himalayas are young mountains. They are not many million years old. They were pushed up at the same time that the Alps were made. They are much younger than the Rockies and the Andes and much, much younger than the Appalachians. (See EXPLORERS; MOUNTAINS; TIBET.)

HIPPOPOTAMUS The hippopotamus is found wild only in tropical Africa. Herds of them are a rather common sight there.

"Hippopotamus" comes from Greek words meaning "river horse." The hippopotamus does spend much time in rivers. But it is not much like a horse. It is a closer relative of the pig.

Weightwise the hippopotamus is bigger than any land animal except the elephant. A male may weigh four tons. With its beady eyes, tiny ears, and huge mouth it is not a handsome animal.

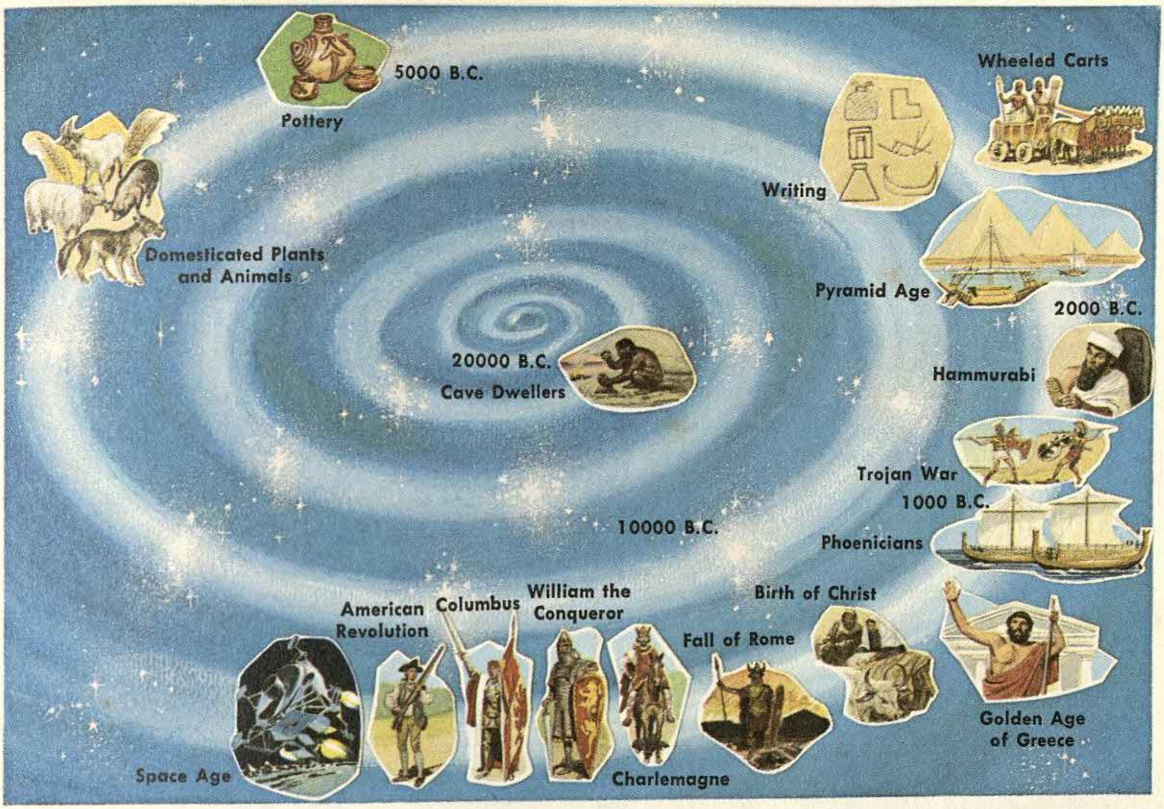
This big mammal often floats with only its flat face above-water. It can then see, hear, and breathe, and still be well hidden by the muddy water of the river. It can also close its nostrils and ears and stay underwater for several minutes at a time.

The hippopotamus rests by day and forages for food at night. It eats mostly grasses, and needs several bushels a day.

Hippos stand captivity well. Some of those in zoos are specimens, not of the common hippoptamus, but of the pygmy hippopotamus, a much smaller relative.

A hippo does not sweat blood, as many people believe. But its skin does give off drops of an oily liquid that looks a little like blood. (See HOOFED ANIMALS.)

Common Hippopotamus



HISTORY History is the story of how today came to be. It is the story of what people all through the ages have thought and done and of what has happened to them.

The story of people begins a very long time ago. Perhaps there have been people on the earth for a million years, perhaps for even longer. We do not know much about the early part of the story. For hundreds of thousands of years our ancestors struggled upward. But they did not make any record of their struggles. They couldn't. They did not know how to write.

The history of people before anyone could write sometimes isn't called history at all. Some people think that the word "history" should be used only for recorded history.

Recorded history is a small chapter in the whole story. For people have been able to write for only about the past 5,500 years. All that we know about their story for the centuries upon centuries before that comes from things they left behind.

Recorded history is divided into three sections—ancient, medieval, and modern history. Ancient history tells the story of the world from about 3500 B.C. to the fall of Rome about 1,500 years ago. Medieval history tells the story of the next 1,000 years. This period of time is called the Middle Ages. Modern history begins not long after the New World was discovered.

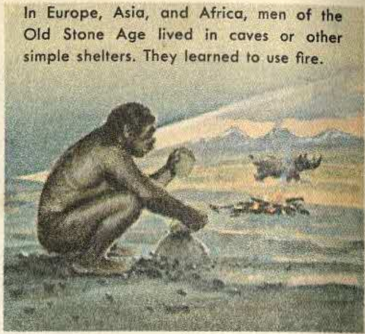
The history of different parts of the world varies greatly. The people of the Near East, for instance, could write long before any of the people of Europe could do so. At the time the people of Europe were building great cathedrals, many native tribes of Africa were building nothing bigger or more lasting than grass huts.

The chart above gives some idea of man's long climb. The next ten pages give a more complete picture story of happenings so important as to stand out above the millions of others. In the main, the first picture in each row dealing with recorded history shows an event that happened at the date given. The other pictures in the row tell a little of what was going on in other parts of the world at the same time.

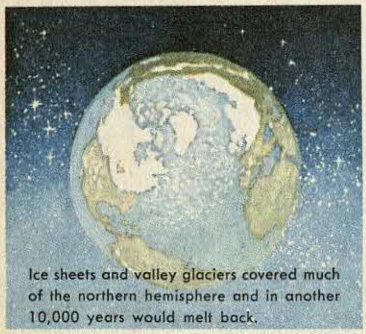
500,000 B.C.

Glaciers of the Ice Age had melted back but were soon to come again.

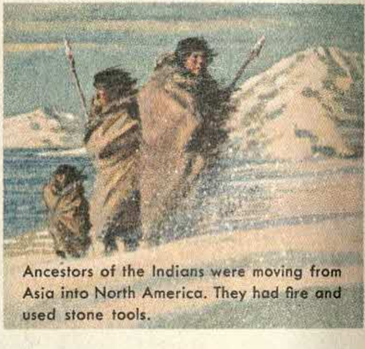
The New World was empty of human life.


In Europe, Asia, and Africa, men of the Old Stone Age lived in caves or other simple shelters. They learned to use fire.

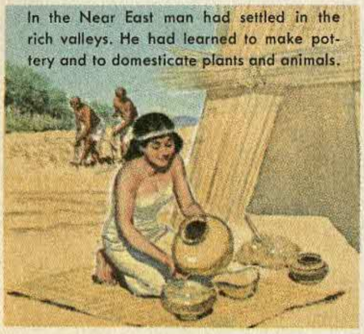
20,000 B.C.


Ice sheets and valley glaciers covered much of the northern hemisphere and in another 10,000 years would melt back.

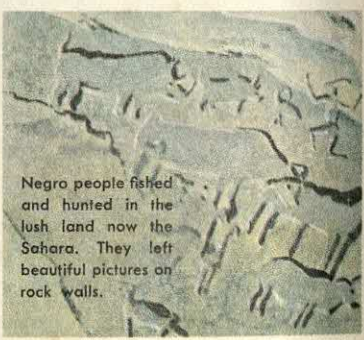
Cave dwellers in southern Europe painted and carved with artistic skill. We can still see some of their work.


Ancestors of the Indians were moving from Asia into North America. They had fire and used stone tools.

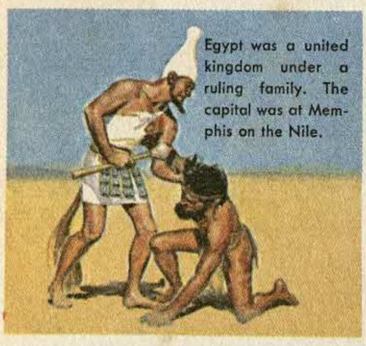
6000 B.C.

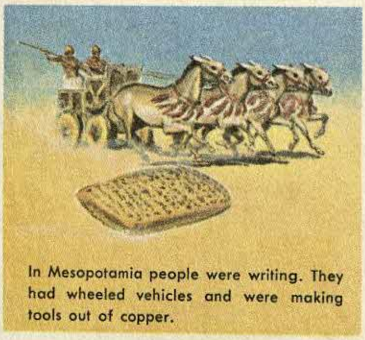

In the Near East man had settled in the rich valleys. He had learned to make pottery and to domesticate plants and animals.

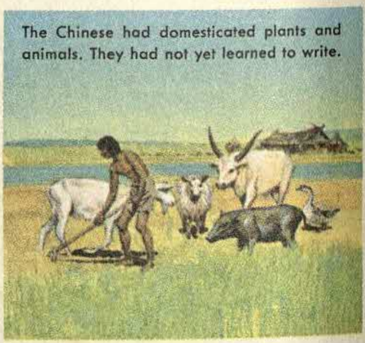
In Europe man was a simple food-gatherer, but he had domesticated the dog.


Negro people fished and hunted in the lush land now the Sahara. They left beautiful pictures on rock walls.

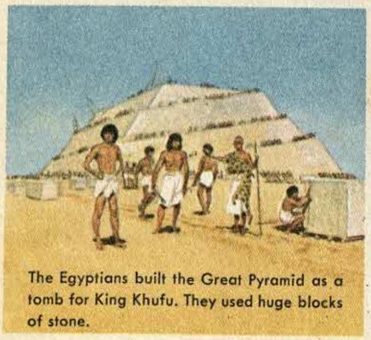
3100 B.C.

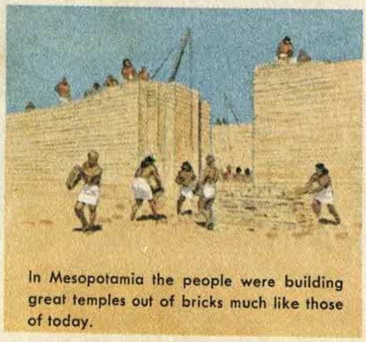

Egypt was a united kingdom under a ruling family. The capital was at Memphis on the Nile.

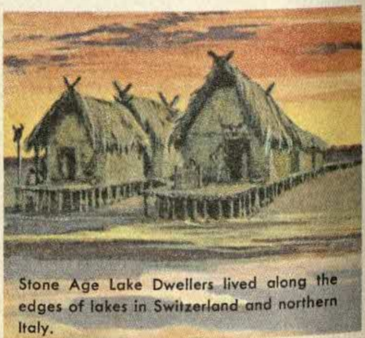

In Mesopotamia people were writing. They had wheeled vehicles and were making tools out of copper.


The Chinese had domesticated plants and animals. They had not yet learned to write.

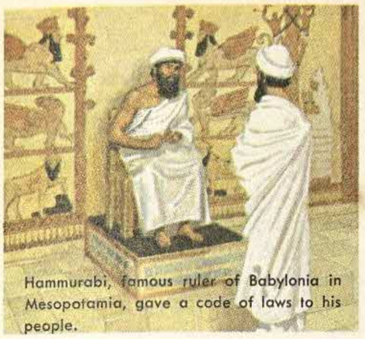
2600 B.C.

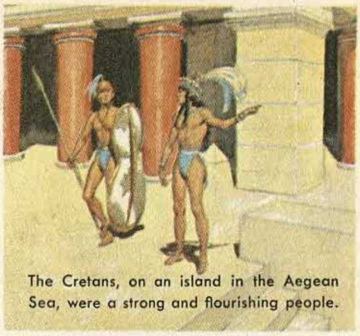

The Egyptians built the Great Pyramid as a tomb for King Khufu. They used huge blocks of stone.

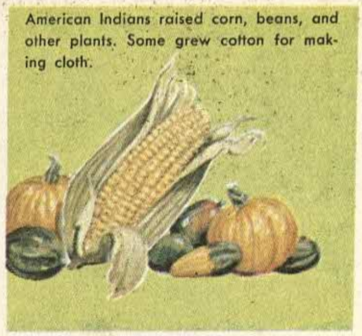

In Mesopotamia the people were building great temples out of bricks much like those of today.


Stone Age Lake Dwellers lived along the edges of lakes in Switzerland and northern Italy.

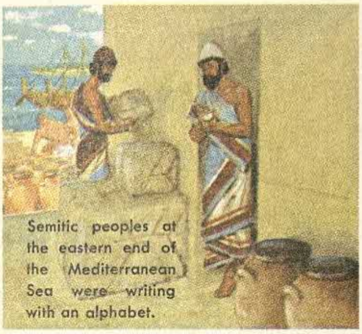
1750 B.C.

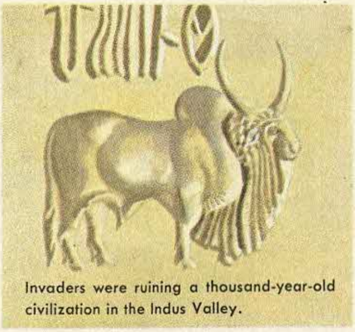

Hammurabi, famous ruler of Babylonia in Mesopotamia, gave a code of laws to his people.


The Cretans, on an island in the Aegean Sea, were a strong and flourishing people.


American Indians raised corn, beans, and other plants. Some grew cotton for making cloth.

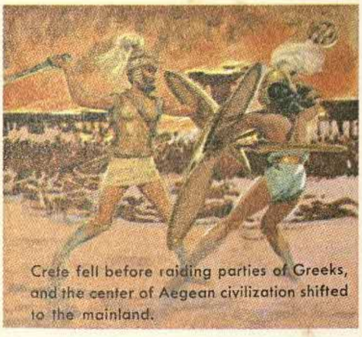
1500 B.C.


Semitic peoples at the eastern end of the Mediterranean Sea were writing with an alphabet.


Invaders were ruining a thousand-year-old civilization in the Indus Valley.

In the Near East iron was coming into use. It was considered the most precious of all metals.

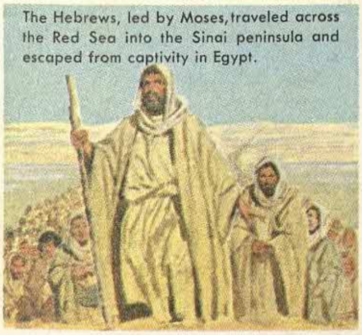
1400 B.C.

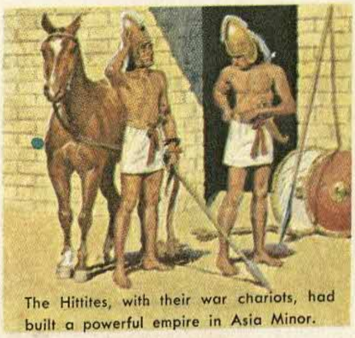

Crete fell before raiding parties of Greeks, and the center of Aegean civilization shifted to the mainland.

Egypt had begun conquering neighboring peoples and building an empire.

Along the Hwang Ho the Chinese had advanced far in farming. They had learned to write and keep records.

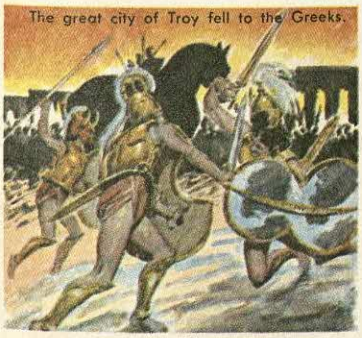
1275 B.C.

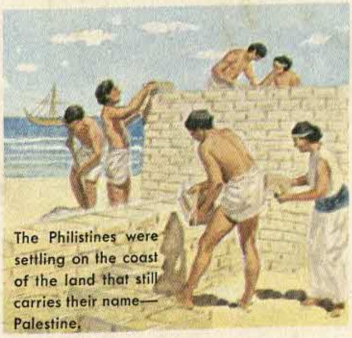

The Hebrews, led by Moses, traveled across the Red Sea into the Sinai peninsula and escaped from captivity in Egypt.


The Hittites, with their war chariots, had built a powerful empire in Asia Minor.

Stone Age people in Australia, the Aborigines, were eking out a bare existence little changed today.

1184 B.C.

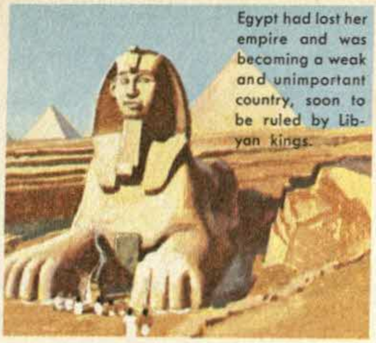

The great city of Troy fell to the Greeks.

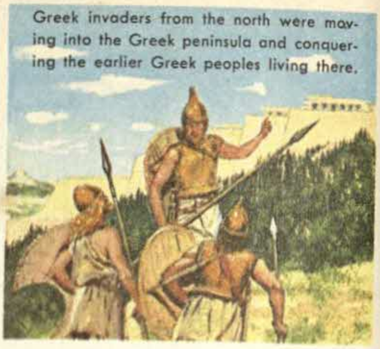

The Philistines were settling on the coast of the land that still carries their name—Palestine.

A Stone Age people whose ancestors had built the mysterious Stonehenge monument lived on the British Isles.

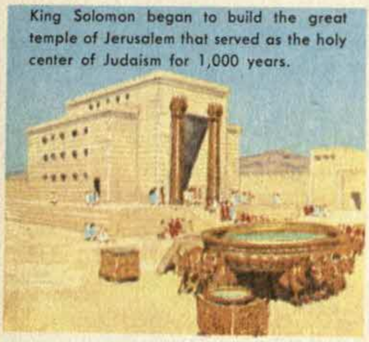
1002 B.C.

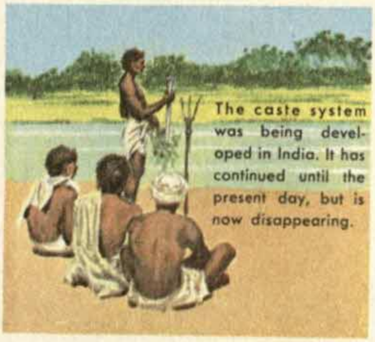
David became the second king of Israel.

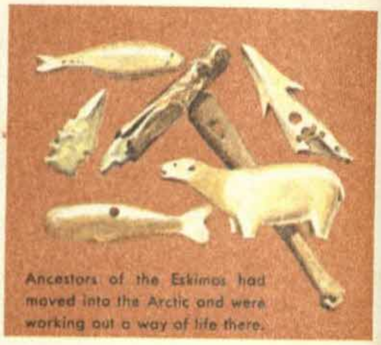

Egypt had lost her empire and was becoming a weak and unimportant country, soon to be ruled by Libyan kings.


Greek invaders from the north were moving into the Greek peninsula and conquering the earlier Greek peoples living there.

959 B.C.


King Solomon began to build the great temple of Jerusalem that served as the holy center of Judaism for 1,000 years.

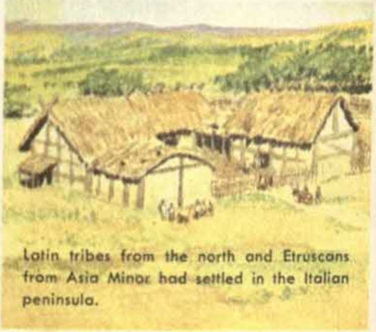

The caste system was being developed in India. It has continued until the present day, but is now disappearing.


Ancestors of the Eskimos had moved into the Arctic and were working out a way of life there.

814 B.C.

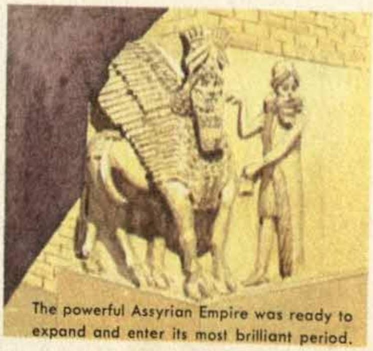
Carthage was founded on the coast of Africa by the seafaring Phoenicians.

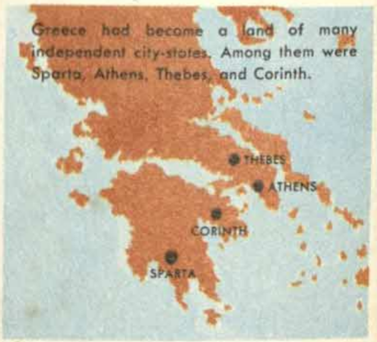
The blind Greek poet Homer was telling the stories that were later written down as the *Iliad* and the *Odyssey*.


Latin tribes from the north and Etruscans from Asia Minor had settled in the Italian peninsula.

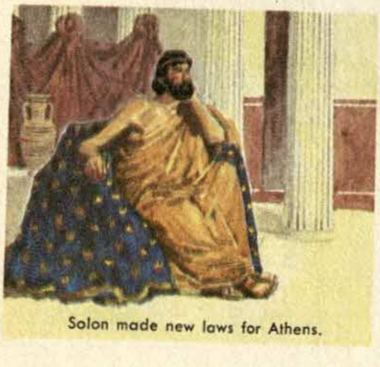
753 B.C.

According to legend, Rome was founded by the twin brothers Romulus and Remus.


The powerful Assyrian Empire was ready to expand and enter its most brilliant period.


Greece had become a land of many independent city-states. Among them were Sparta, Athens, Thebes, and Corinth.

594 B.C.


Solon made new laws for Athens.

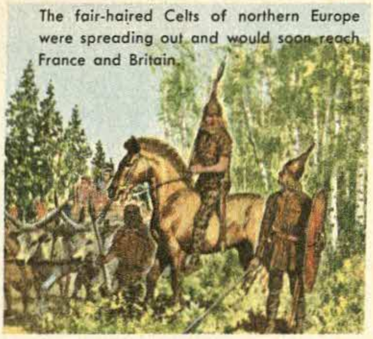
The civilization of the Etruscans flourished on the Italian peninsula. Etruscan kings ruled Rome.

Nebuchadrezzar ruled in Babylon. The Babylonian Empire was at its height.

525 B.C.

Persia conquered Egypt. She now controlled all the land at the eastern end of the Mediterranean Sea.

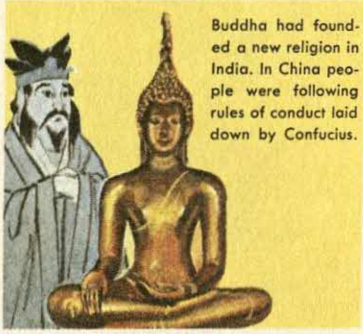
In Lydia of Asia Minor and in nearby Greece, the earliest coins were being minted.


The fair-haired Celts of northern Europe were spreading out and would soon reach France and Britain.

490 B.C.

At Marathon the Greeks defeated the powerful Persians and kept them from overrunning Europe.

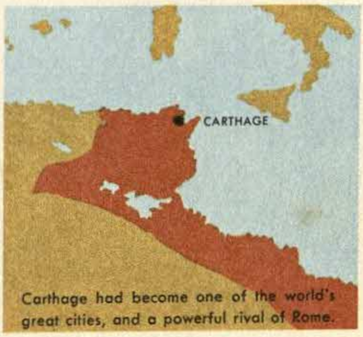
Rome had overthrown its Etruscan rulers and had developed its own republican form of government.


Buddha had founded a new religion in India. In China people were following rules of conduct laid down by Confucius.

323 B.C.

After conquering most of the civilized world, Alexander the Great died at the age of 33.

Rome was fighting her neighbors for more territory throughout the Italian peninsula.

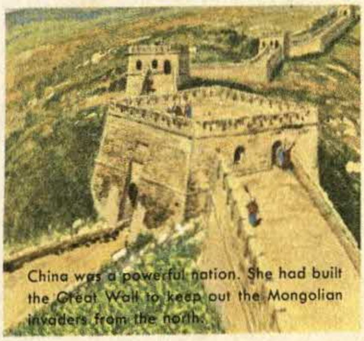


Carthage had become one of the world's great cities, and a powerful rival of Rome.

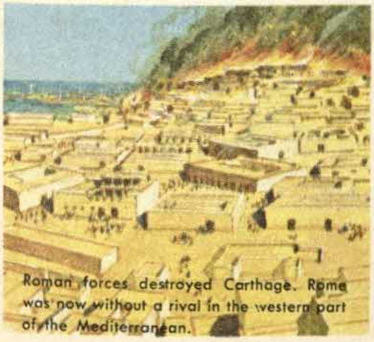
202 B.C.

Hannibal led a huge army of Carthaginians against Rome and was defeated.

Buddhism had made many converts in India and was spreading throughout other lands in Asia.


China was a powerful nation. She had built the Great Wall to keep out the Mongolian invaders from the north.

146 B.C.


Roman forces destroyed Carthage. Rome was now without a rival in the western part of the Mediterranean.

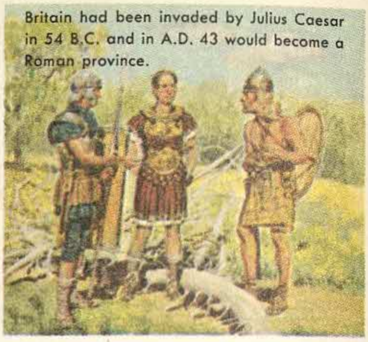
Greece, now a province of Rome, had greatly influenced Roman thought, art, architecture, and literature.

In Egypt, under the Greek Ptolemies, Alexandria had become one of the great cities of the world.

6 B.C.

Jesus was born in Bethlehem, a small city in the Roman province of Judea.

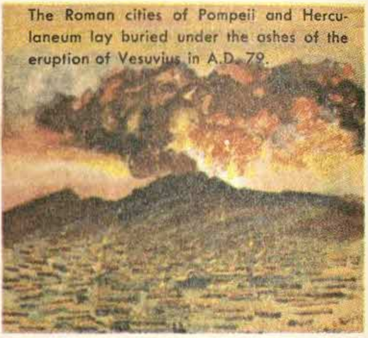
Under Augustus, the Roman Empire was entering its Golden Age. The whole Mediterranean world was ruled by Rome.


Britain had been invaded by Julius Caesar in 54 B.C. and in A.D. 43 would become a Roman province.

105

In China the invention of paper was reported to the emperor. The invention paved the way for the spread of literature.

St. Paul had established the first Christian church. The Christian faith was spreading through the Roman Empire.


The Roman cities of Pompeii and Herculaneum lay buried under the ashes of the eruption of Vesuvius in A.D. 79.

410

Rome was looted by Visigoths led by Alaric.

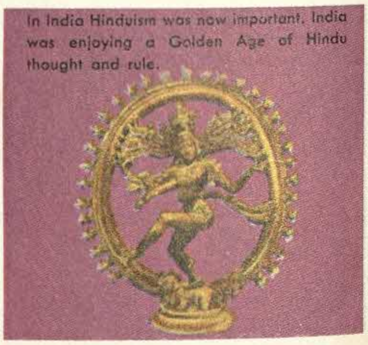
In 330 the capital of the Roman Empire had been moved from Rome to Constantinople, in what is now Turkey.

The Huns had advanced westward from the Gobi Desert into central Europe, burning and plundering as they came.

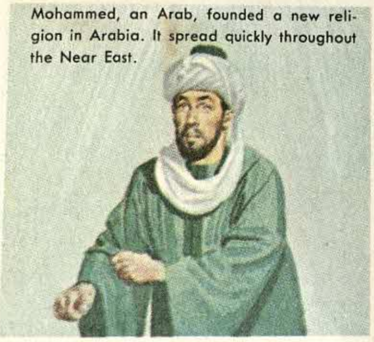
476

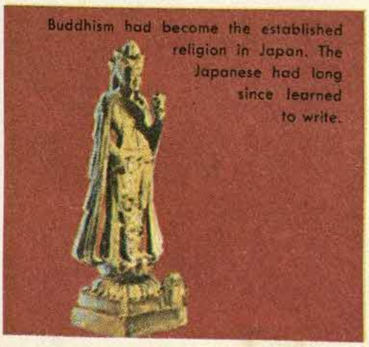
The city of Rome fell to Germanic tribes from the north, and the Middle Ages of Europe began.

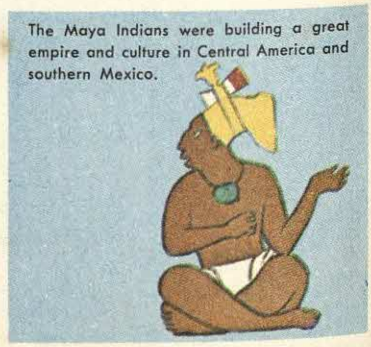
The Angles, Saxons, and Jutes, Germanic tribes, had invaded Britain and were dominating it.


In India Hinduism was now important. India was enjoying a Golden Age of Hindu thought and rule.

622

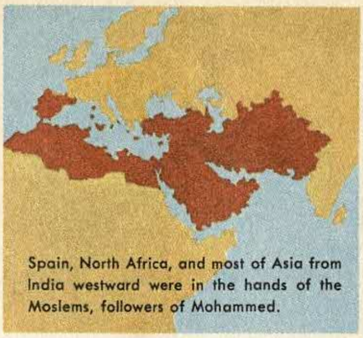

Mohammed, an Arab, founded a new religion in Arabia. It spread quickly throughout the Near East.


Buddhism had become the established religion in Japan. The Japanese had long since learned to write.


The Maya Indians were building a great empire and culture in Central America and southern Mexico.

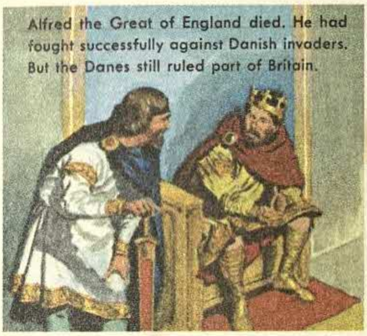
800

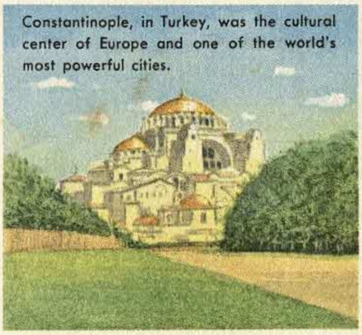
In Rome on Christmas Day the pope crowned Charlemagne Emperor of the West.

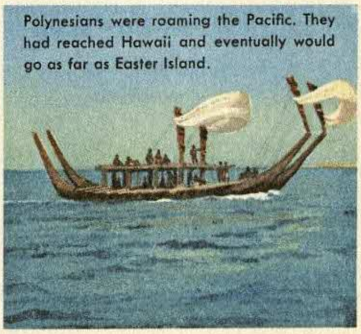

Spain, North Africa, and most of Asia from India westward were in the hands of the Moslems, followers of Mohammed.

The Vikings, or Norsemen, were plundering and terrorizing towns along the northern coast of Europe.

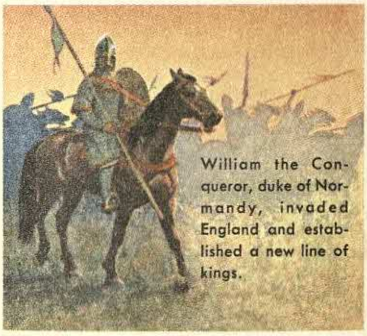
899

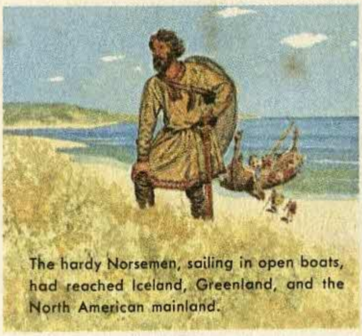

Alfred the Great of England died. He had fought successfully against Danish invaders. But the Danes still ruled part of Britain.


Constantinople, in Turkey, was the cultural center of Europe and one of the world's most powerful cities.


Polynesians were roaming the Pacific. They had reached Hawaii and eventually would go as far as Easter Island.

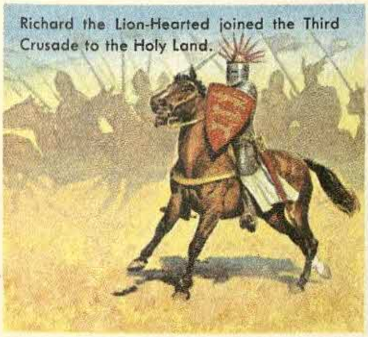
1066

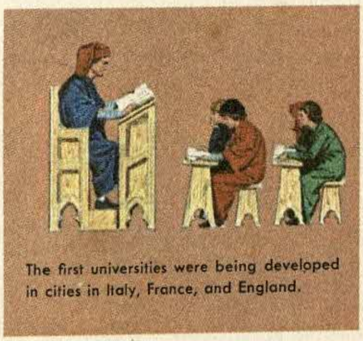

William the Conqueror, duke of Normandy, invaded England and established a new line of kings.

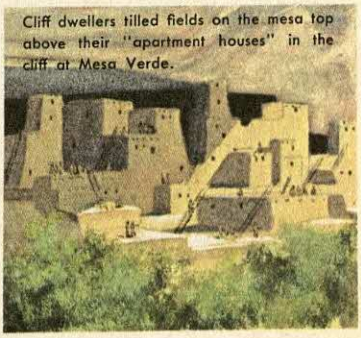

The hardy Norsemen, sailing in open boats, had reached Iceland, Greenland, and the North American mainland.

The Chinese had invented printing and were using movable earthenware type.

1189

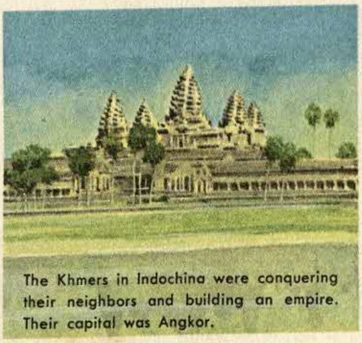

Richard the Lion-Hearted joined the Third Crusade to the Holy Land.


The first universities were being developed in cities in Italy, France, and England.


Cliff dwellers tilled fields on the mesa top above their "apartment houses" in the cliff at Mesa Verde.

1215

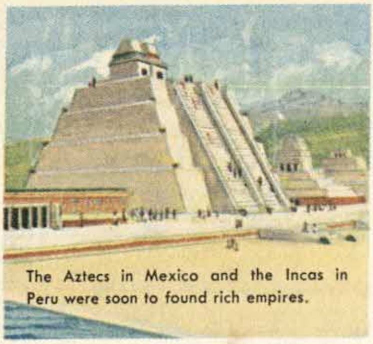
King John signed the Magna Carta, thereby ending absolute rule by the king in England.


The Khmers in Indochina were conquering their neighbors and building an empire. Their capital was Angkor.

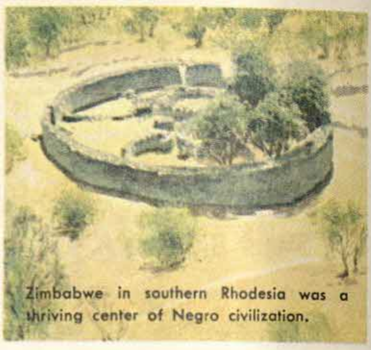
The Mongols, or Golden Horde, under Genghis Khan were conquering China and were soon to sweep westward into Russia.

1337

Giotto, great Italian painter of the early Renaissance, died. The Renaissance was soon to spread throughout Europe.



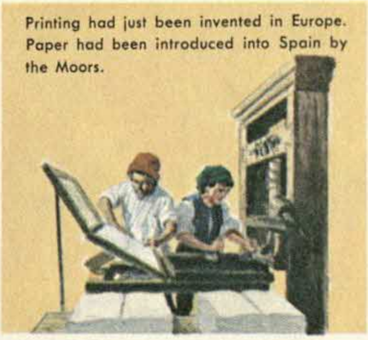
The Aztecs in Mexico and the Incas in Peru were soon to found rich empires.



Zimbabwe in southern Rhodesia was a thriving center of Negro civilization.

1453

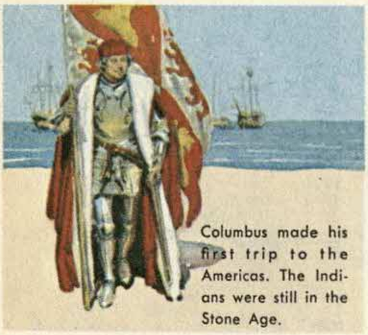
Constantinople fell to the Turks, and the Eastern, or Byzantine, Empire that had lasted 1,000 years ended.



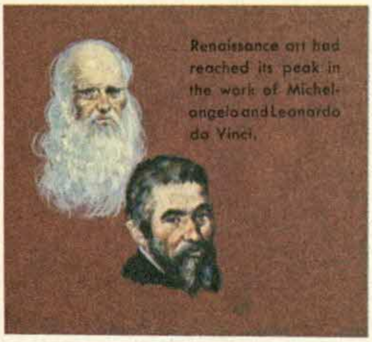
Printing had just been invented in Europe. Paper had been introduced into Spain by the Moors.

Joan of Arc, in 1429, had helped the French win a victory at Orléans in the Hundred Years' War between England and France.

1492



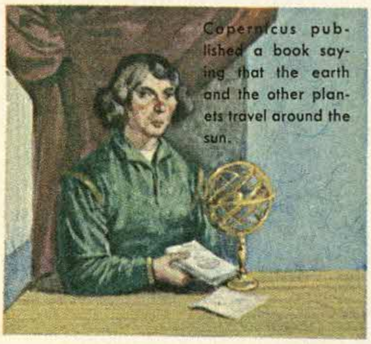
Columbus made his first trip to the Americas. The Indians were still in the Stone Age.



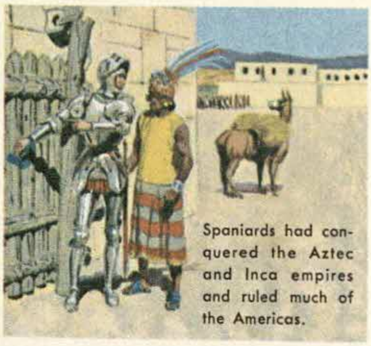
Renaissance art had reached its peak in the work of Michelangelo and Leonardo da Vinci.

The Moors were driven from Spain by Ferdinand and Isabella. Spain began playing a large role in European affairs.

1543



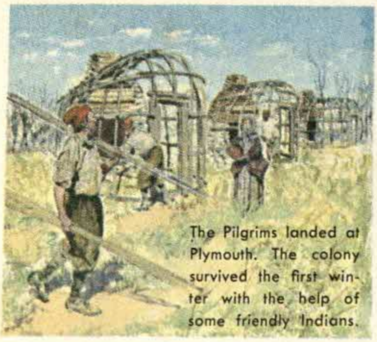
Copernicus published a book saying that the earth and the other planets travel around the sun.



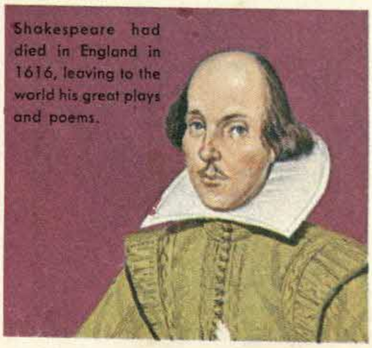
Spaniards had conquered the Aztec and Inca empires and ruled much of the Americas.

China had shut her doors to European traders. For 300 years she had very little contact with western countries.

1620



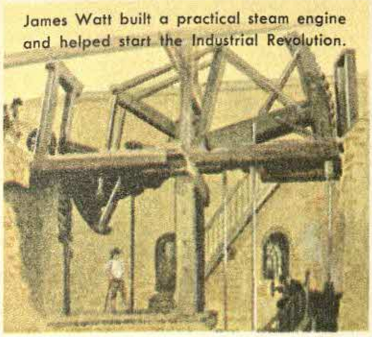
The Pilgrims landed at Plymouth. The colony survived the first winter with the help of some friendly Indians.



Shakespeare had died in England in 1616, leaving to the world his great plays and poems.

In Italy, Galileo was showing people how to gain scientific knowledge by experimenting.

1769

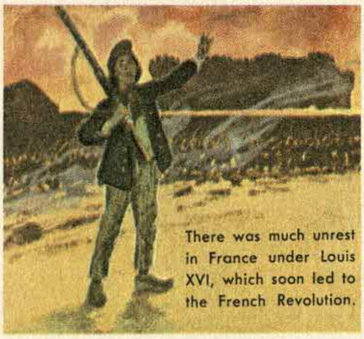

James Watt built a practical steam engine and helped start the Industrial Revolution.

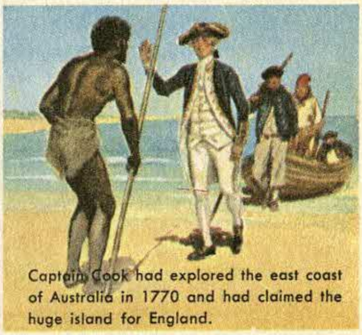
Prussia was the most powerful state of north and central Germany under the rule of Frederick the Great.

Russia was ruled by the empress Catherine the Great. In her reign Russia gained territory in eastern Europe.

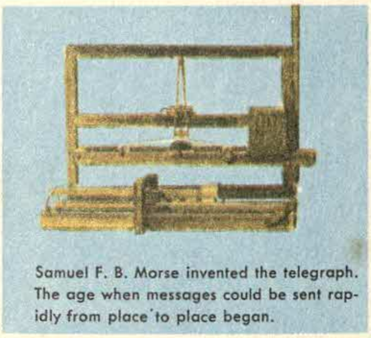
1781

The American colonies gained their freedom in the American Revolution.


There was much unrest in France under Louis XVI, which soon led to the French Revolution.


Captain Cook had explored the east coast of Australia in 1770 and had claimed the huge island for England.

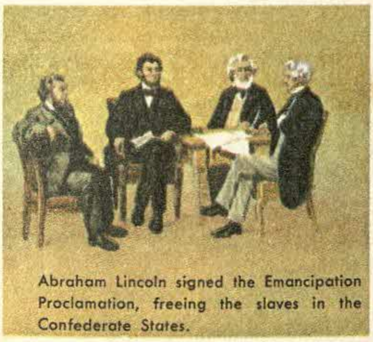
1837

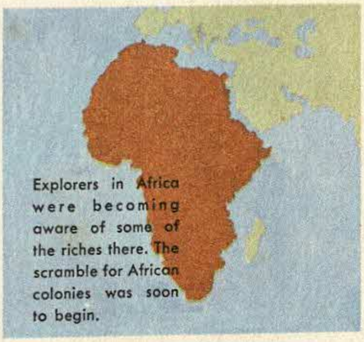

Samuel F. B. Morse invented the telegraph. The age when messages could be sent rapidly from place to place began.

Spanish rule in South America had been ended in 1819 by the great military leader Simón Bolívar.

Napoleon had lost the great empire he had built up, and France was once again ruled by a king.

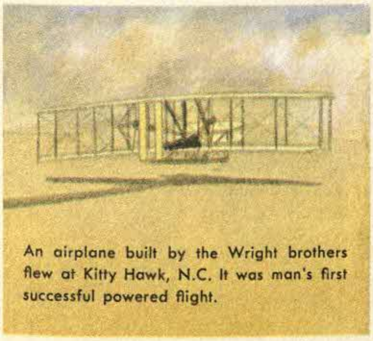
1863

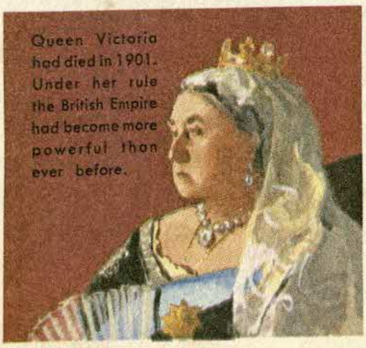

Abraham Lincoln signed the Emancipation Proclamation, freeing the slaves in the Confederate States.

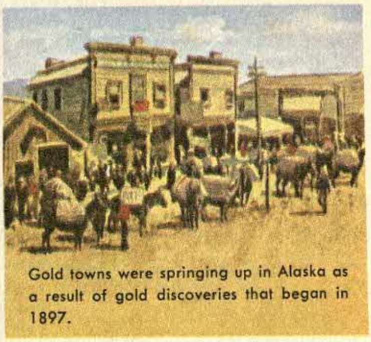

Explorers in Africa were becoming aware of some of the riches there. The scramble for African colonies was soon to begin.

The discovery of gold in southern Australia in 1851 had brought many people to that new land.

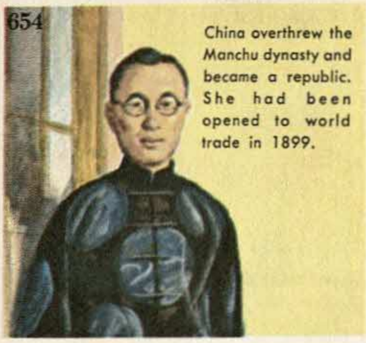
1903


An airplane built by the Wright brothers flew at Kitty Hawk, N.C. It was man's first successful powered flight.


Queen Victoria had died in 1901. Under her rule the British Empire had become more powerful than ever before.


Gold towns were springing up in Alaska as a result of gold discoveries that began in 1897.

1911

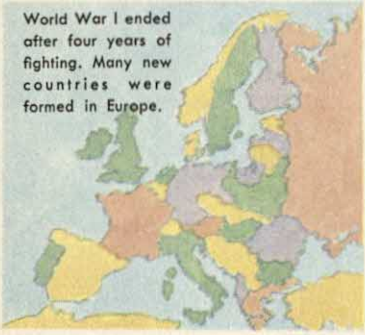


China overthrew the Manchu dynasty and became a republic. She had been opened to world trade in 1899.

The Panama Canal was nearing completion. The first ship would go through in 1914.

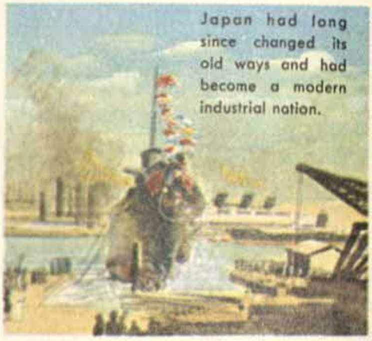
The German Empire, with possessions in Africa and the Pacific, had become a world power.

1918



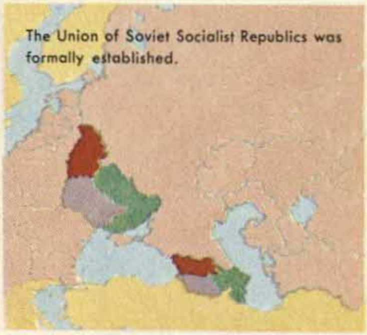
World War I ended after four years of fighting. Many new countries were formed in Europe.

The Russians had overthrown their czar in 1917 and were working out a communist form of government.



Japan had long since changed its old ways and had become a modern industrial nation.

1922

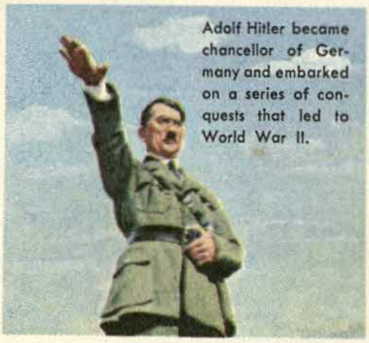


The Union of Soviet Socialist Republics was formally established.

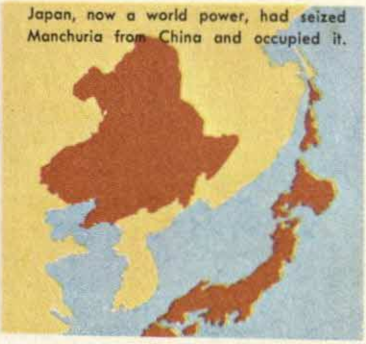
The 19th amendment to the Constitution, ratified in 1920, had given women in the U.S. the right to vote.

Kemal Atatürk was setting out to make Turkey a modern nation.

1933



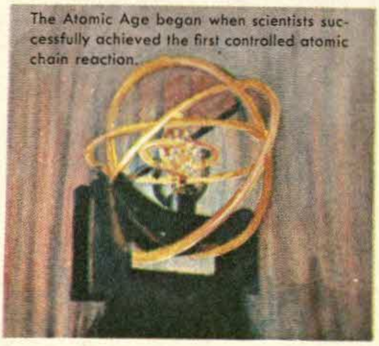
Adolf Hitler became chancellor of Germany and embarked on a series of conquests that led to World War II.



Japan, now a world power, had seized Manchuria from China and occupied it.

Charles Lindbergh had made the first nonstop solo flight across the Atlantic in 1927, going from New York to Paris.

1942

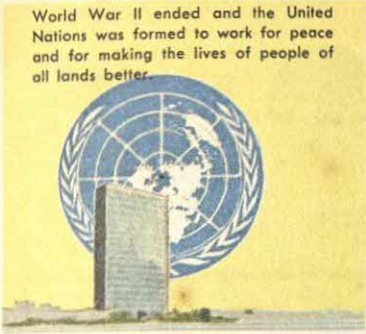


The Atomic Age began when scientists successfully achieved the first controlled atomic chain reaction.

World War II was being waged. Almost all the countries in the world were involved.

Ghandi was waging a peaceful campaign for Indian independence.

1945

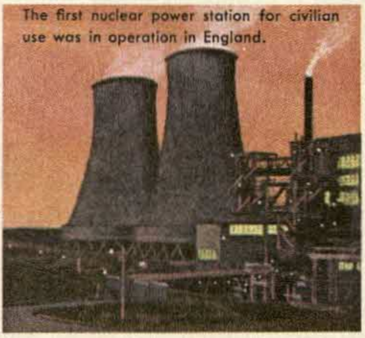

World War II ended and the United Nations was formed to work for peace and for making the lives of people of all lands better.

Communism had spread into southeastern Europe and over China and North Korea.

A great move toward independence was under way among colonial possessions in Africa as well as in India.

1957

Sputnik I, the first artificial satellite, was launched by the U.S.S.R. and was soon followed by the U.S.'s Explorer I.


The first nuclear power station for civilian use was in operation in England.

In Arabia Ibn Saud had built an oil-rich nation from wandering Bedouin tribes.

1961

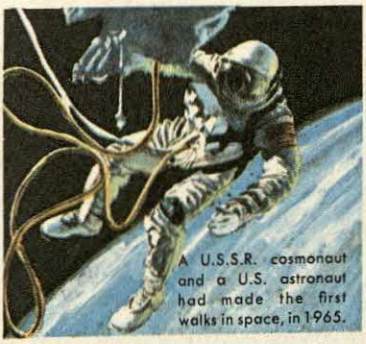
The first manned satellites were put in orbit by the U.S.S.R. and the U.S.

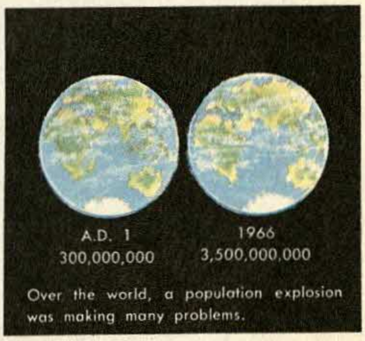
Fidel Castro, Communist leader, had gained control of Cuba in 1959.

There was growing unrest and turmoil in many of the newly established nations of the world.

1966

Early Bird, the first commercial communications satellite, was put in orbit.


A U.S.S.R. cosmonaut and a U.S. astronaut had made the first walks in space, in 1965.

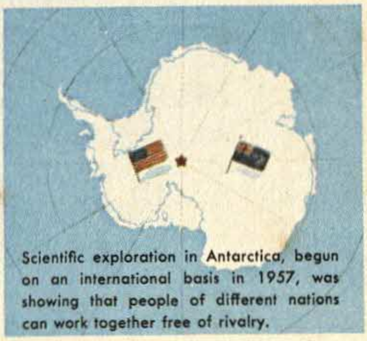


Over the world, a population explosion was making many problems.

1968

Saturn V launched a manned Apollo satellite in rehearsal for a moon landing.

Throughout the world progress was being made in furnishing educational opportunities for all.


Scientific exploration in Antarctica, begun on an international basis in 1957, was showing that people of different nations can work together free of rivalry.

HOBBIES In the days when most work was done by hand there was not much time for fun. In early factories even children sometimes worked 15 or 16 hours a day. For grown-ups 40 hours is now the ordinary work week. For boys and girls school lasts only about 6 hours a day, and there is a long summer vacation. Almost everyone has time to spend as he pleases. Much spare time is now spent on hobbies. A hobby is making or doing or learning something just for the fun of it. Any hobby would be work if one had to spend time on it; it is play since there is no must about it.

Making a collection is the commonest hobby. People collect all sorts of things. China animals, campaign buttons, coins, butterflies, rocks, and stamps are a few of them. Stamps are the most popular of all. Some stamp collectors have collections worth many thousands of dollars.

Painting is the hobby of a great many people. Some other popular hobbies are gardening, knitting, singing, playing a musical instrument, sewing, making pottery, building model planes and cars, hiking, mountain climbing, studying the stars, and learning a new language. Hobby shows are held in many places. It is surprising what strange and unusual hobbies one finds out about at these shows.

A hobby sometimes stops being a hobby and becomes a person's work. A man who has been raising flowers as a hobby may start raising them to sell. A woman who likes to sew may start doing it for a living. A child's hobby may become his work when he grows up. Audubon spent much of his spare time as a boy watching birds. As a man he made himself famous by his beautiful pictures of birds. Raymond L. Ditmars had a hobby of collecting snakes as a boy. He grew up to be a world authority on reptiles and became head of the reptile section of a big zoo.

Doctors tell us that being very much interested in something helps keep us well mentally. It is good, therefore, for a person to have a hobby. Of course, he may have more than one. When a person applies for college or a new job, he often has to answer a long list of questions. His answers tell a great deal about what kind of person he is. One question is apt to be, "What are your hobbies?" (See AGASSIZ; AUDUBON; FABRE; LINNAEUS.)

HOCKEY In vacant lots and quiet alleys boys sometimes play a game called shinny. They use crooked sticks and a tin can, ball, or block of wood. Each team tries to knock the object through the goal of the other team. When shinny is played on a grass-covered field with carefully made sticks and a leather-covered ball, the game is called field hockey.

There are 11 persons on each team in field hockey. A game is made up of two 35-minute halves, with a 5-minute half time between them.

In United States schools that play field hockey most of the teams are made up of girls. In girls' hockey the halves are not more than 30 minutes long.

Ice hockey is played on ice rather than grass. This game is one of the leading sports in Canada and the United States. There are ice hockey leagues like those for basketball, baseball, and football.

In ice hockey there are only six men on each team. A disk of rubber called a puck is used instead of a ball. There are three 20-minute periods in a game. In college games if the score is tied at the end of the third period there is an extra "sudden-death" 10-minute period. As soon as someone scores, the game ends.

Ice hockey is a very fast game. A good player has to have learned special ice-skating techniques for sudden stops and starts and turns.

It would seem strange for a football or basketball team to play with fewer men than there are on the other team. But one team in an ice hockey game is often short-handed for a while. If a player breaks a a rule he is put in the penalty box. He must stay there for a certain number of minutes. No one is allowed to take his place on the ice while he is out of the game.

Ice Hockey

TUTE OF EDUCATION ★ Govt. of West Bengal

New Year's Day	Jan. 1
Lincoln's Birthday	Feb. 12
Valentine's Day	Feb. 14
Washington's Birthday	(3rd Monday in Feb.)* Feb. 22
St. Patrick's Day	March 17
April Fools' Day	April 1
Palm Sunday	Sunday before Easter
Good Friday	Friday before Easter
Easter	In March or April (Movable)
Arbor Day	Movable
May Day	May 1
Mother's Day	2nd Sunday in May
Memorial Day	(Last Monday in May)* May 30
Flag Day	June 14
Father's Day	3rd Sunday in June
Independence Day	July 4
Labor Day	1st Monday in Sept.
Yom Kippur	Movable
Columbus Day	(2nd Monday in Oct.)* Oct. 12
Halloween	Oct. 31
Election Day	1st Tuesday after 1st Monday in Nov.
Veterans Day	(4th Monday in Oct.)* Nov. 11
Thanksgiving	4th Thursday in Nov.
Hanukkah (Festival of Lights)	Movable
Christmas	Dec. 25

*Beginning in 1971

HOLIDAYS The word "holiday" comes from the words "holy day." Holidays were first religious festivals. Now many holidays have nothing to do with religion. Almost every country has holidays honoring important events or people in its history.

Some holidays are celebrated in many countries. Some are observed in just one. Some are celebrated in only one part of one country. Some are celebrated by the people of only one religion.

Halloween always comes on the same date of the same month. Many other holidays do. But some do not. Some, such as Easter, are movable holidays. Easter is the first Sunday after the first full moon on or after the beginning of spring. It can be as early as March 22 or as late as April 25.

Every person has his own private holiday when he is given gifts by his family and friends. It is his birthday.

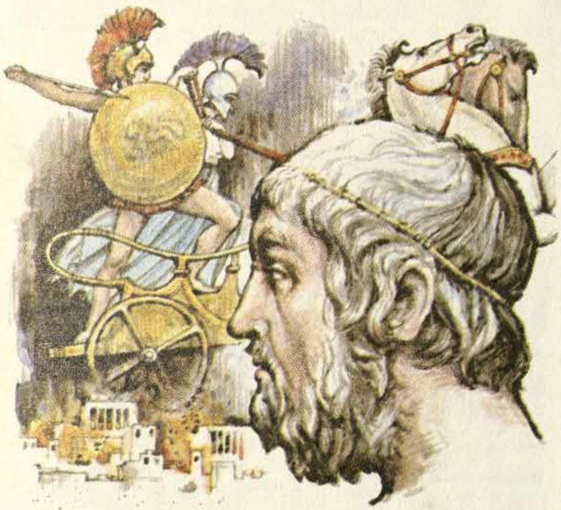
The list between the pictures names 25 of the holidays most widely celebrated in the United States. It also tells when each of these holidays is celebrated.

HOLLY Almost everyone thinks of a sprig of shiny green leaves and red berries when he hears the word "holly," because sprigs of holly are common at Christmastime. The holly comes from holly trees. A holly tree grows to be about 50 feet tall. The tree is shaped like a pyramid. Its trunk may be

3 feet in diameter. The bark is smooth. Before there are berries, there are white flowers on a holly tree. The berries grow from the white flowers.

Holly wood is white. It is much used for fancy woodwork.

There are about 300 kinds of holly. Not all of them are trees. Some are shrubs less than 10 feet tall. Most of the many kinds are in Central and South America. In the United States holly is found wild along the Atlantic coast and in the South. Farms in the Northwest raise holly and ship it far and wide for Christmas decorations.



HOMER Two of the world's most famous poems are the *Iliad* and the *Odyssey*. The *Iliad* is the story of the Trojan War. The *Odyssey* is the story of the wanderings of the Greek hero Ulysses after the Trojan War. The poems are so long that each one fills an entire book.

The author of these poems, most people believe, was a blind Greek poet named Homer. But no one knows anything about Homer. No one knows when or where he was born. There are pictures and busts of Homer, but they are based only on imagination. Some people think that there never was such a person. Other people think that Homer really lived but that he did not write the poems. They believe that he was a minstrel who went about singing poems that had been made up in earlier times. It is surely true that the Greeks told the stories of Ulysses and the Trojan War long before anyone wrote them down.

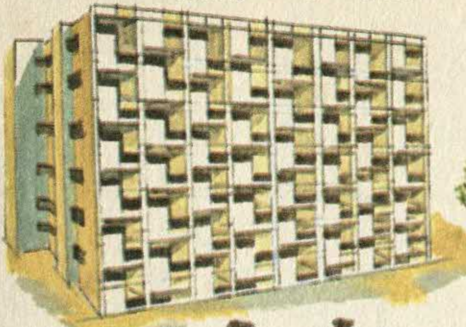
Whether there ever was a Homer does not really matter. For we have the poems, and they are two of the greatest poems of their kind ever written. They have lived for more than 2,500 years and are still widely read. (See ACHILLES; LITERATURE; TROJAN WAR.)

HOMES "There's no place like home," the song "Home, Sweet Home" tells us. But home for one person may be very different from home for another. For one it may mean a small house up on stilts near a seashore. For another it may mean a brick or frame house with many rooms. For others it may mean a tent of felt or skin, an igloo, an apartment 20 stories above the street, a grass hut, a stone cottage, a boat tied up to a riverbank, or even a cave.

To most of us, "cave dwellers" means the peoples who lived in natural rocky caves in southern Europe thousands of years ago. Today, however, there are many cave dwellers living in man-made caves cut into hills of clay. These cave dwellers have been given a special name—troglodytes. A cave home may have a single room; it may have many. It is pleasantly cool in summer and warm in winter.

Homes are different partly because they are made of different materials. A man in a jungle in tropical Africa could not build a snow igloo even if he wanted to. An Eskimo could not have a house made of banana leaves and bamboo.

Houses are different partly because they are built to fit different climates. In a land with cold winters a person wants a snug house that will shut out the cold winter winds and keep the heat from his fire inside. In a hot, rainy land one wants a house with a roof that will shed rain easily and with walls that are open enough to let


Housing Development, Egypt

"Habitat," Montreal

Thatched Cottage

Antebellum Mansion, U.S.A.

New Guinea

Medieval Castle

Swiss Chalet

Marina Towers, Chicago

House Trailer

Chinese Houseboat

Australia

Sumatra

Borneo

Eskimo Igloo

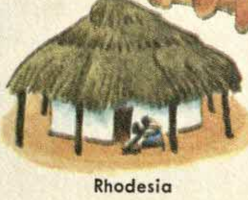
Indian Tepee

China

Nigeria

Arabia

Central Asia


Rhodesia

breezes blow through. Cave homes in clay hillsides are found only in dry regions.

A person's home, moreover, must fit his way of living. A nomad would not want a sturdy house built of brick or stone. He has to have a home that he can carry with him when he moves his herds to new pastures or one that he can travel in.

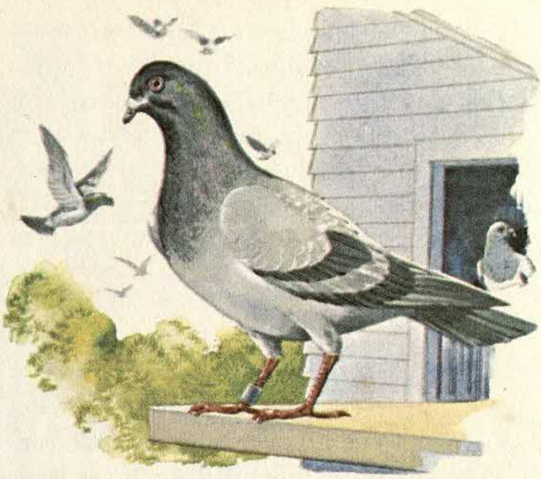
The first lasting houses we know about were little one-room round huts built over pits in the ground. The low walls were of stone or clay or wood. There were probably no windows or chimneys. These homes could not have been very pleasant. In winter, living in them must have been a good deal like living inside a stove.

In the thousands of years since these first houses were built, people have learned to build better and better houses. A person who lived in one of the early round houses would marvel if he could come into a modern house. The plumbing, the electric lights, the big windows, the air conditioners, and the furnace, stove, and refrigerator would seem to him like magic.

Some of the buildings pictured are apartment houses. Building many homes together began long ago. Back in ancient Rome there were apartment buildings several stories high. They were made of concrete and wood and were called *insulae* (islands). But in our apartments we have many comforts Roman apartments did not have.

Many people imagine that the castles of the Middle Ages were wonderful homes. They *were* wonderful compared with the huts clustered near their walls. But most castles were damp, dirty, and gloomy.

Modern homes are built in many styles. Thousands of people earn their living by planning houses that will be convenient, comfortable, and attractive. Experiments with new materials are constantly going on. Tomorrow's houses will be better than the houses of today, just as today's are far ahead of the houses of long ago. (See ARCHITECTURE; BUILDING MATERIALS; CASTLES; HOUSEBOATS.)



HOMING PIGEON Most birds find their way back to their homes easily. But homing pigeons are especially good at doing so. Because they are good at finding their way home over long distances, people have used them as messengers for many centuries. The Egyptians sent messages by them at least as early as 2400 B.C. In the 12th century Genghis Khan had pigeon posts across his vast domain.

The message to be carried is fastened to the pigeon. Usually it is in a small container attached to the bird's leg.

Homing pigeons travel fast. One pigeon carried a message 90 miles in 110 minutes. Another flew 40 miles in 40 minutes.

Although these pigeons naturally make good message carriers, they can be trained to be better ones. They can, for instance, be trained to fly faster and to go into their loft the minute they reach it.

In the past homing pigeons have been especially helpful as messengers in wartime. Several pigeons have been war heroes. At Verdun, in France, for instance, there is a plaque honoring homing pigeon No. 183/140F. In World War I this pigeon carried a message which saved Verdun.

In these days of electronics, pigeons are less important as message carriers than they used to be. In 1956 the United States Army decided that it no longer needed any pigeon messengers.

Homing pigeon races are held from time to time. But in many of the races in recent years large numbers of pigeons have failed to reach home. Some pigeon raisers blame TV aerials, hawks, or bad weather. Others blame radio waves. No one can tell surely what is to blame, for no one yet knows how pigeons find their way home. (See PIGEONS; SPEED.)

HONG KONG On some small maps of huge China, Hong Kong looks as if it were a part of that country. It is not. But it borders southeastern China and is not far from China's big city Canton (Kwangchow). Hong Kong is a British Crown Colony.

Though Hong Kong is small in size, it is an important bit of the Commonwealth. And it has three parts. Two parts have been owned by the British since the middle of the 1800's. They are a small peninsula of Asia's mainland, and the hilly little island of Hong Kong nearby. Every day ferryboats carry hundreds of people between those parts. The trip is only about a mile long. The third part is next door to the peninsula. In 1898 the British leased this territory from China for 99 years.

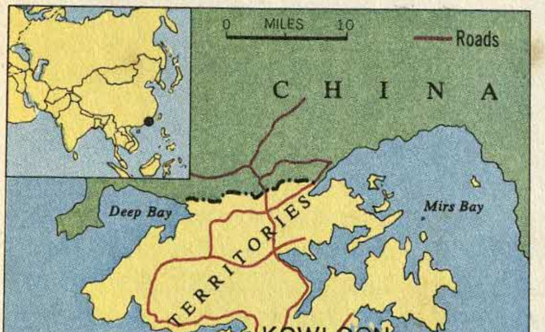
The cities of Victoria and Kowloon both border Hong Kong's great harbor. So does Hong Kong's international Kai Tak airport. Planes and ships from near and far take part in the vast trade that goes on in Hong Kong. This trade helps thousands of British and hundreds of thousands of Chinese to make a living there. And it has helped to make Hong Kong famous throughout the world. (See BRITISH COMMONWEALTH.)

HOOFED ANIMALS The feet of a tiger and a horse are very different. The toes of a tiger end in sharp claws. A horse's toes end in hoofs. Claws are very helpful to a meat-eating animal. Hoofs are much better than claws for one that grazes.

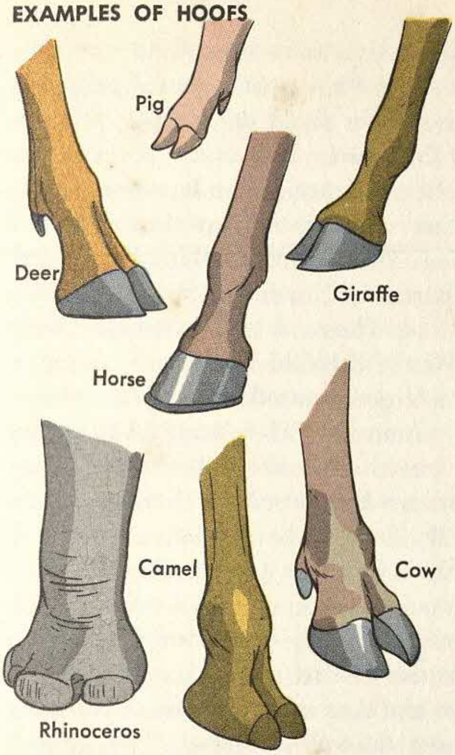
Another name for the animals with hoofs is ungulates. The name comes from a Latin word meaning "nail" or "hoof."

Except for the pig, which eats both plant and animal food, the hoofed animals are plant eaters. Many of them chew a cud. They all live on the ground and move about by walking or running. Some of them are swift, others rather slow and clumsy. One, the tree hyrax, is a tree climber. Only a few spend much time in the water.

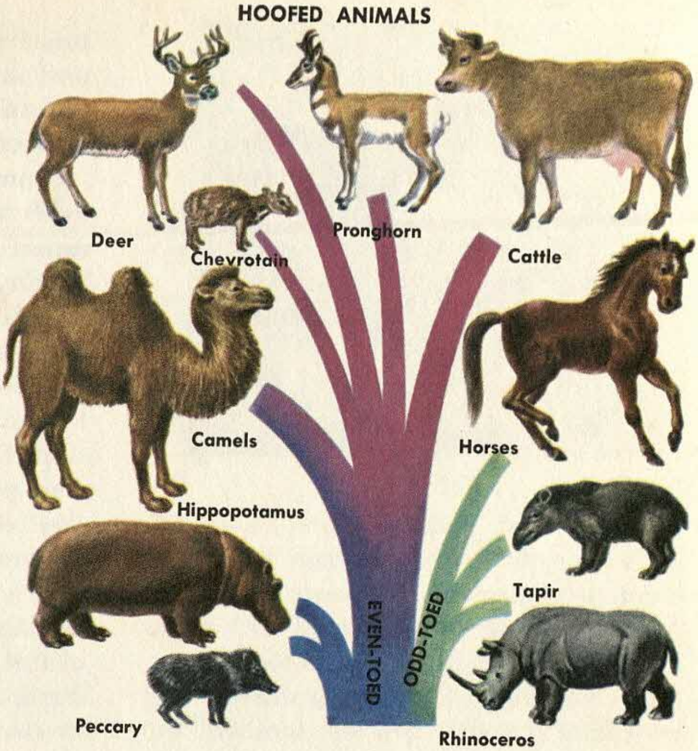
Some hoofed animals have an even number of toes, the others, of course, an odd number. The odd-toes group is a small one. In it are the donkey, horse, rhinoceros, tapir, and zebra. The even-toes group is



Harbor of Hong Kong



EXAMPLES OF HOOFS



HOOFED ANIMALS

much larger. It includes the alpaca, antelope, bison, camel, cow, deer, gazelle, giraffe, goat, hippopotamus, hyrax, llama, musk-ox, okapi, pig, pronghorn, sheep, yak, and zebu.

It is easy to see that hoofed animals are important to us. Most of our meat and all our milk come from hoofed animals. (See DOMESTICATED ANIMALS; HORNS AND ANTLERS; MAMMALS.)

HORNS AND ANTLERS The three animals pictured are among the mammals with horns. Their horns, however, differ.

The horns of the bighorn sheep, like those of all sheep and cattle, are made mostly of horn, a material much like that our fingernails are made of. The horns have a hollow core of bone. Sheep and cattle never shed their horns.

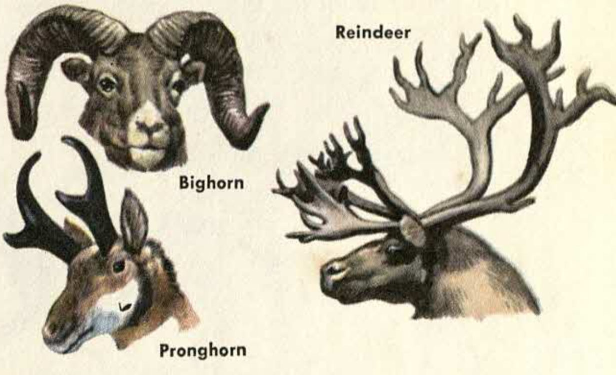
The branched horns, or antlers, of the reindeer, like those of all deer, are made of bone. A deer sheds its antlers every year. Its new ones at first are covered with a soft furry skin called velvet.

The horns of the pronghorn are made of bone covered with horn like those of the bighorn, and they are never shed. But the horn cover is shed like the velvet of a deer's antlers.

Rhinoceros horns have no horn and no bone. They are made of hair fused together.

The biggest horns known are those of the Irish elk, which disappeared in the Ice Age. Its horns stretched 11 feet or so from tip to tip. They may have been the elk's undoing. They were too heavy and unwieldy to be good weapons against fast-moving meat eaters like wolves.

The one long horn of the unicorn is well known from pictures. But the unicorn never existed. It is purely legendary.



Mesohippus

HORSES Fifty million years ago some small animals no bigger than foxes ran about in the swampy forests of North America. These little animals had short necks and short faces. Their teeth were fitted for eating only tender leaves. On each front foot they had four toes, and on each hind foot three. These small animals are best known as eohippus, or dawn horse. Small though they were, they were the ancestors of today's horses. The name scientists give eohippus is *Hyracotherium.*

As millions of years passed, conditions on the earth changed. The dawn horses changed, too. After many, many generations they were larger. They had longer necks, longer faces, and longer legs, and on their front feet as well as the back ones they had only three toes. Each middle toe, moreover, was bigger than the side toes. These descendants of little eohippus were so different from it that scientists have given them another name—*Mesohippus.*

The ancestors of the horse kept on changing. At last they came to be much like the horse of today. Their teeth were good for chewing tough grasses. On each foot all the toes had disappeared except the middle one, and on it there was a good hard hoof. The animals ran about on the tips of their toes—on their heavy toenails.

From North America the horse spread to every other continent except Australia and Antarctica. Then a strange thing happened. All the horses in North and South America disappeared. Those of today all came from wild horses of the Old World.

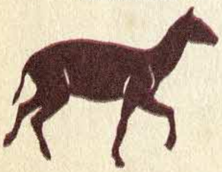
The cavemen hunted horses just as they hunted mammoths. They wanted them for food. Even when horses were tamed, they were perhaps first raised for their meat and their milk. But the horse soon came to be more valued as a beast of burden.

In ancient times and all through the Middle Ages one of the most important uses of the horse was to help in wars. Ancient Egyptian and Assyrian rulers went to battle in chariots drawn by horses. The knights of the Middle Ages had suits of armor for their horses as well as for themselves.

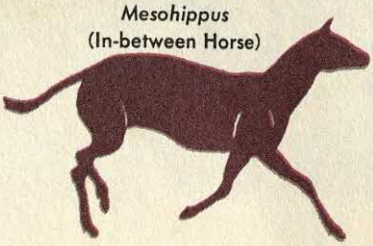
Many people have the idea that there were wild horses on the plains of North America when Columbus discovered America. They think that the Indians caught and tamed these wild horses. This idea is wrong. The Indians had never seen horses until the Spaniards brought them. Some of the Spanish horses escaped or were stolen. The wild horses, or mustangs, the Indians tamed came from these Spanish horses.

Our horses of today have been pretty much made to order. For some purposes speed is more important than strength. For some purposes it was better to have little horses. For other purposes big ones were

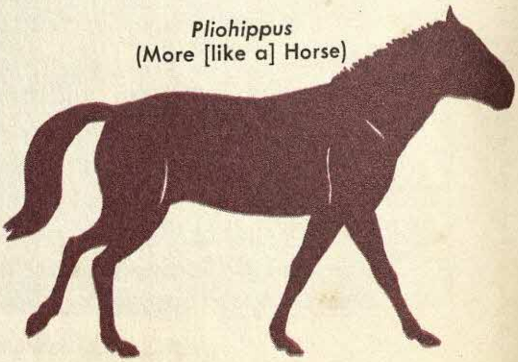
Eohippus
(Dawn Horse)



Mesohippus
(In-between Horse)



Pliohippus
(More [like a] Horse)



better. Hundreds of years ago people began changing horses to suit themselves. They developed different kinds of horses to help in different ways. The picture at the right shows a few of our types of horses.

Some people think that the word Thoroughbred means purebred. But the horse we call the Thoroughbred is a special kind of purebred horse. The horses that run in most running races are Thoroughbreds. Thoroughbreds are also used as riding horses, polo ponies, and hunting horses.

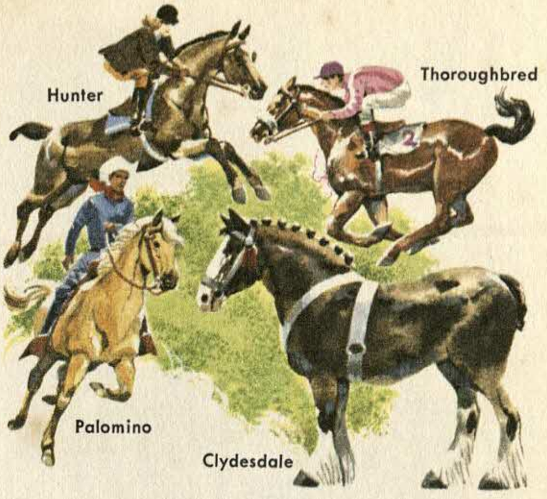
All Thoroughbreds have some Arabian blood. The Arabs for centuries have been famous for their horses. Thoroughbreds began with the mating of English mares and Arab stallions.

Morgan horses are good harness horses. They are good riding horses, too. All Morgans are descended from an Arabian-Dutch-Thoroughbred stallion that became known by the name of its owner, Justin Morgan.

The American Saddle Horse is another horse that was developed in America. This breed gives us the gaited horses that are so important in horse shows.

The Clydesdale is a very heavy horse. It is one of the several kinds of draft horses. No one would enter a Clydesdale in a race with a Thoroughbred. But the powerful draft horses can pull heavy loads.

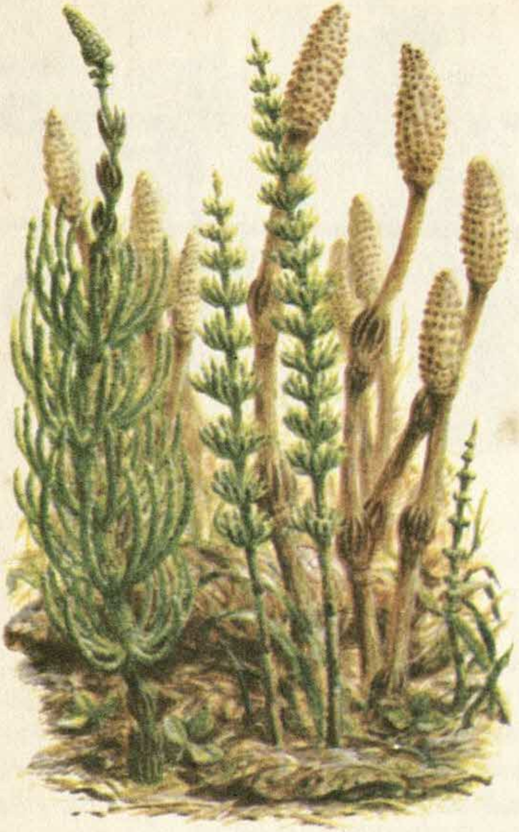
Palomino horses are popular as riding and parade horses. A Palomino's coat is a beautiful golden tan and its mane and tail are white or silver. Palomino coloring comes in several breeds. Many Palominos have a great deal of Arab in them.



Small horses are best for children and for certain kinds of work. Ponies of different kinds were therefore developed. The Shetlands are the most famous. They originally came from the Shetland Islands.

In 1920 there were more than 25,000,000 horses in the United States. Today there are less than a million. Our cars, trucks, and tractors have largely taken the place of the horse. But man will always need and raise horses for some purposes. Machines can never wholly take their place. (See DOMESTICATED ANIMALS; HOOFED ANIMALS; MAMMALS.)

Modern Horse



HORSETAILS Small plants called horsetails are often found on cinder slopes along railroad tracks, where almost no other plants will grow. They are found, too, in barren, sandy regions and along the damp edges of swamps.

These plants are sometimes called joint grass because their stems are jointed. The main stem of a horsetail is underground. The stems aboveground are hollow except at the joints and in most cases are only about as big around as soda straws. Horsetails have nothing that looks like leaves. Each joint on the stem has a circle of "teeth," relics of leaves horsetails of long ago had. The green stems do the food making that their leaves do for most green plants.

Horsetails are sometimes called scouring rushes. Their stems are so gritty that they can be used to scour pots and pans.

Like the ferns and club mosses, horsetails have spores, not seeds. Since they are not seed plants, they do not have flowers. Their spores are formed in cones.

Some of the horsetails of long ago were very large. In the swampy forests of the Coal Age there were tree horsetails with trunks three feet thick. But in time flowering plants crowded them out. (See CLUB MOSSES; FERNS; PLANT KINGDOM.)

HOSPITALS Having a place where sick people can be cared for is not a new idea. In ancient Babylonia, Egypt, and Greece temples served as resting places for the sick. But the story of hospitals as special places for treating diseases begins about 1,600 years ago. By that time Christians were setting up hospitals at various places in the Roman Empire. One hospital, perhaps the very first, was founded in 369 in Caesarea, a city in what is now Israel.

In Europe during the Middle Ages monks helped care for the sick. There were hospitals adjoining many monasteries. The doctors of the Middle Ages did not do much of their work in hospitals. Most of the patients in hospitals were homeless, very poor, or hopelessly sick.

The oldest of the hospitals now existing in the Americas is the Hospital of Jesus of Nazareth in Mexico City. Cortés founded it in 1524. The oldest hospital in the United States is the Pennsylvania Hospital in Philadelphia. It was founded in 1751.

War has had a great deal to do with the setting up of hospitals. Florence Nightingale's work in military hospitals during the Crimean War in the 1850's did a great deal to improve nursing.

Today there are many thousands of hospitals in the world. The United States has about 7,000. In all countries except the United States most of the hospitals are government owned.

Some of today's hospitals are for special purposes. They may be for children only, for people with contagious diseases, for people who are crippled, or for women who are having babies. In many cases, however, one big hospital simply has separate sections for patients with different needs.

Fifty years ago the idea of going to a hospital still frightened most people. They preferred to stay at home and let their family doctors look after them. But the picture has changed. In the United States and in many other places, too, family doctors have become fewer and fewer. And going to the hospital is now an everyday affair. There are in the United States alone over a million inpatient admissions to hospitals each year. An inpatient is one who must have a hospital room. And there are more than 100,000,000 outpatient visits. Outpatients go to the hospital for checkups or treatments that do not call for an overnight stay. The average stay of an inpatient in a hospital is 7½ days.

It is not surprising that many doctors prefer to treat their patients in hospitals. In hospitals they have wonderful equipment at hand. There are sure to be, for instance, X-ray laboratories and excellent operating rooms. And there are skilled nurses.

For a long time hospitals were rather cheerless places. They had a disagreeable hospital smell, too, that came from the chemicals used in killing germs. Now many hospital rooms are gay and cheerful. And the hospital smell is gone. Doctors have found out that most patients get well faster if their surroundings are pleasant.

Hospitals of today do more than simply look after patients. Many help train young doctors. Many help train nurses, too. And in many studies are being carried on to find out more about the causes of diseases and to find better ways of treating them. (See NIGHTINGALE, FLORENCE.)

HOTELS AND MOTELS When people began making long journeys, they needed places to stop for the night. Inns were built.

The first inns we know about were in lands at the eastern end of the Mediterranean Sea. The rooms were built around a court where horses and donkeys and camels could be kept. "Caravansary" is another name for an inn of this kind.

The pictures give some idea of what the inns of long ago have grown into. A hotel like the city hotel pictured may have rooms for hundreds of people, large dining rooms, and big rooms for meetings and exhibits. The biggest hotel in the world is the Conrad Hilton in Chicago. In it there are 3,000 rooms. But there are small hotels, too, some still called inns.

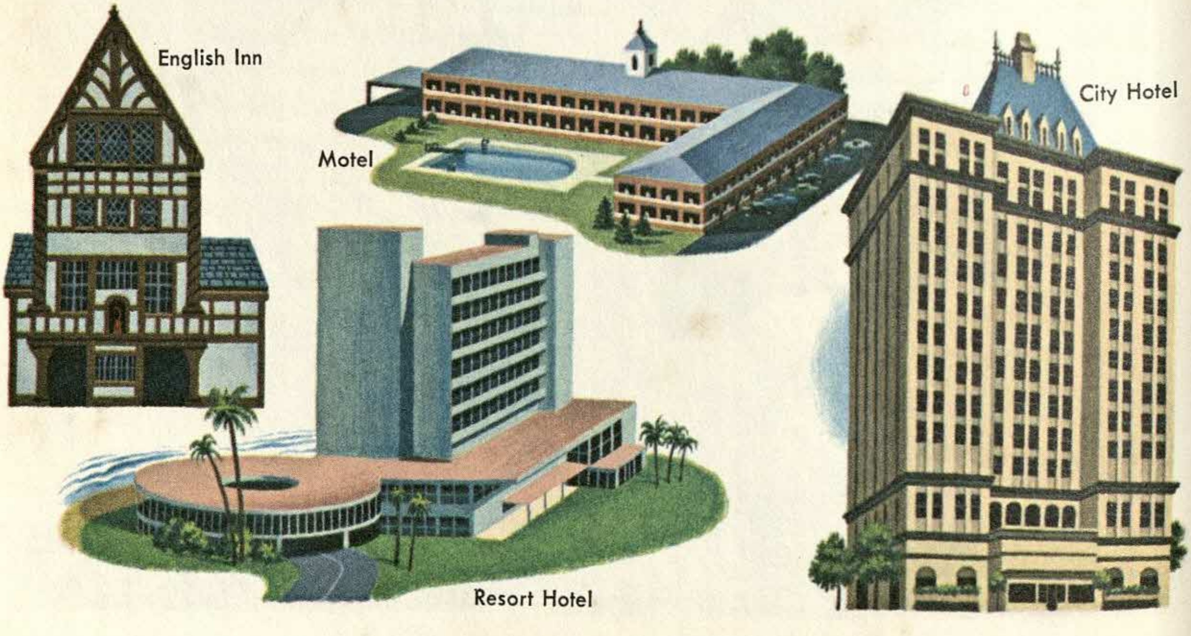
Hotels can be divided roughly into three groups. There are resort hotels, where people go for a vacation. They are mostly near the sea or a lake or in the mountains. There are residence hotels. People may make their homes in them for months or even years. And there are transient hotels—hotels planned for people who stay only a short time. Many of these hotels are in the hearts of cities. They are convenient for tourists and for people who come to the cities for conventions or on business.

Motels belong in the transient group. They are meant for people who travel by car. "Motel" is short for "motor hotel." Motels are found in towns and cities and along highways. In many motels a person can drive right to the door of his room. In city motels, some of them many stories high, there are special parking areas.

Youth hostels are in the transient group, too. They are mostly for young people on walking or cycling trips. Many hostels furnish nothing but a place to sleep and a kitchen where food can be cooked.

Big hotels and motels have worked out many ways of making their guests comfortable. Many rooms are air-conditioned. In the rooms are television sets, radios, and telephones. Ice water is at hand. Clothes can be cleaned and pressed in a very short time. Meals can be served in the rooms as well as in the dining rooms. In many hotels there are flower shops, gift shops, beauty shops, drugstores, and dress shops.

Hotels are a big business. There are more than 65,000 hotels and motels in the United States alone. There are several big chains of hotels. It is possible to visit many cities in the United States, and even some in other countries, and still always stay in hotels of the same chain.



Roman Bath

Hot Spring, Alaska

Hot Spring, Yellowstone

HOT SPRINGS Springs where cold water comes bubbling out of the ground are common. Springs of hot water are not nearly as common. But there are hot springs in a number of different places.

The water in hot springs gets its heat from very hot rock not far below the surface of the ground. A hole dug down deep enough anywhere on the earth would come to hot rock. Most of the places where the hot rock is rather close to the top of the ground are near volcanoes, either dead ones or ones that are still active.

For a hot spring there must be a tube, or channel, in which water can gather. The tube must reach upward from the hot rock to the surface of the ground. As cold water enters the tube it sinks to the bottom. The moving of cold water to the bottom pushes the hot water out of the top.

Many hot springs have craters around them. These craters are built of minerals dissolved in the hot water. When the water comes out of the spring it gets cool. Then it cannot hold as much mineral matter as it held when it was hot. Some of the water, moreover, evaporates. As it does, it leaves its minerals behind. Besides, in the water there are tiny plants called algae. They help make the water drop its minerals.

The craters around hot springs often have beautiful colors in them. The water itself may be colored, too. The colors come from the algae.

Some algae can live in water that is almost hot enough to boil. For other algae the water must be cooler. The colors that are found most in the pools around hot springs are salmon pink, orange, brown, yellow, and green.

Some hot springs do not spill over. They look like pots of boiling mush. If the mud is colored by algae, these springs are called paint pots.

Yellowstone National Park has hundreds of hot springs. Hot Springs, Ark., was named for nearby hot springs. Part of the name of Iceland's capital, Reykjavík, means "smokes." The "smokes" is from steam rising from hot springs there. New Zealand and Japan also have many hot springs.

The people of Iceland, New Zealand, and Japan have put their hot springs to good use. They pipe hot water from them to heat buildings. New Zealand uses them to run power plants. In Hot Springs, Ark., and many other places there are health resorts near hot springs. The English city of Bath has been famous for its hot spring baths since Roman times. (See GEYSER.)

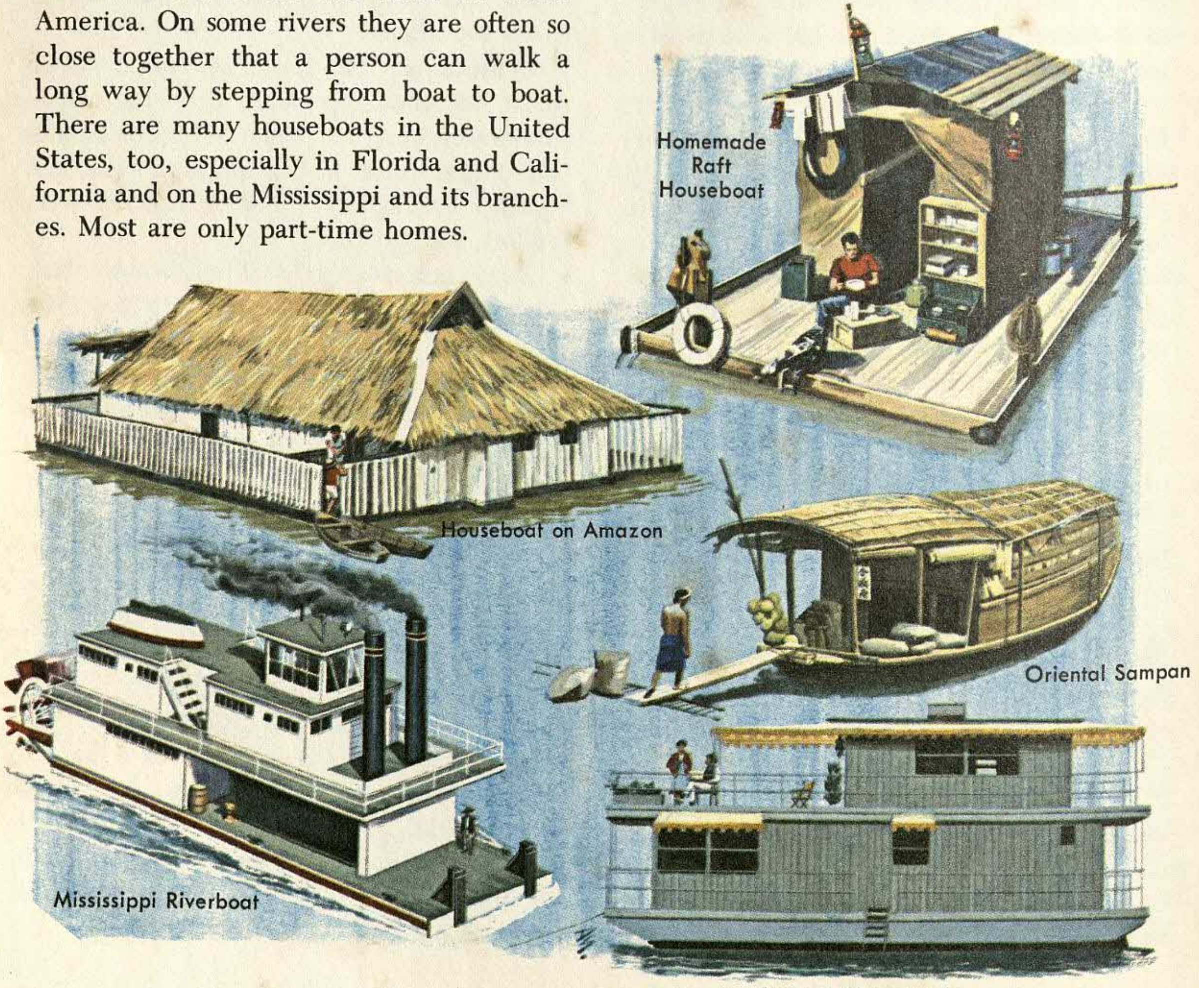
HOUSEBOATS Some people live their whole lives on boats without ever seeing much of the world. They live on houseboats of the kind not built to travel by themselves. When a family living on such a houseboat wants to move, they have to either have the boat towed to another place or get another one there.

Many houseboats, on the other hand, are seaworthy homes. People can live in them the year around or spend weekends and vacations cruising about on them. These houseboats have engines or sails to move them. They are for the most part broad of beam to provide living space, and flat-bottomed so that they can travel in shallow water and be beached easily for stopovers.

Houseboats are very common in China. Riverbanks near towns and cities are often lined with them. They are common also on the rivers in the hot lands of South America. On some rivers they are often so close together that a person can walk a long way by stepping from boat to boat. There are many houseboats in the United States, too, especially in Florida and California and on the Mississippi and its branches. Most are only part-time homes.

People have houseboats for different reasons. In China a family may live on a houseboat because they do not have any land for a house. In South America a family may live on a houseboat because it is hard to cut down enough trees to clear a space for a house. In the United States people live on houseboats partly because they like the idea of being able to move whenever they want to.

There are many ways in which living on a houseboat is fun. But there can be some problems. The living quarters are often crowded. Getting good water is not always easy. Even though there is water all around, that water is never safe to drink. Getting rid of rubbish may not be easy, either. Often, moreover, the dampness on boats is a nuisance. It is not hard to see why most people prefer a house to a houseboat.



HOUSE PLANTS People who like flowers can have them the year round. They can have them even in the middle of winter. For there are many plants that will bloom indoors. Some plants are pretty just because of their leaves, not their flowers. Many of these, too, will grow very well indoors. Plants that are kept indoors are called house plants.

Many house plants are started in greenhouses. They are sold when they are old enough to be pretty. Among the very popular house plants flower shops sell are chrysanthemums, azaleas, begonias, and tulips.

After these plants come into our houses they may live for a long time. Or they may die very soon. How long they live depends mostly on how well they are taken care of. Not all house plants should be treated the same way. Some need to be in bright sunlight; others cannot stand it. Some need water every day; others should not be watered as often. Some need more warmth than others. Some cannot stand drafts. Some should have extra plant food once in a while. Often a plant that comes from a flower shop has a card with it that tells how to take care of the plant.

Not all house plants come from flower shops. It is fun to raise one's own plants. If a person has an African violet or a begonia, he can raise new plants from the leaves of the plant he has. Geraniums are among the many plants that can be raised from slips, or small branches.

Some house plants can be raised from bulbs. The bulbs may not need any soil at all. Paper-white narcissus bulbs, for example, will grow and bloom if they are planted in pebbles and water.

A very pretty vine can be raised from a common sweet potato. It needs only to be stood up in a jar of water. Beautiful feathery little plants will grow from the top halves of carrots.

Some house plants can be raised indoors from seeds. Morning glory and nasturtium are two that can be. They will bloom indoors if they have just the right amounts of water and warmth and sunshine, and if their pots are the right size. Grapefruit seeds will not grow into grapefruit trees indoors, but they will grow into pretty plants with shiny leaves. Avocado seeds, too, will grow into beautiful plants.

Whole little gardens can be raised in glass "greenhouses" indoors. The greenhouse may be a big glass bottle or a fishbowl with a glass cover or a container bought at a flower shop. Little plants such as mosses and tiny ferns can be gathered outdoors for it. A garden of this kind is called a terrarium. Many people make terrariums a hobby. (See BULBS; GREENHOUSE; HOBBIES.)

HOUSTON In 1930 Houston, Tex., was a middle-sized city of about 300,000 people. Today it is the sixth largest city in the United States. Well over a million people live there. Few cities have grown as fast.

The story of Houston begins shortly after Texas won its freedom from Mexico in 1836 and became a republic. General Sam Houston, who had led the Texans to the victory at San Jacinto that ended the war, was made president. The new republic needed a capital, and the Texans decided to build a new city and name it Houston. The city was built where two sluggish bayous came together. By the time Texas became a state, the capital had been moved to Austin.

Even though no longer the capital, Houston grew. Cotton had much to do with its success. Huge amounts were raised round about and brought to Houston for shipping.

The city was given a big boost when oil was discovered in the region in 1901. Large refineries were soon built.

To make it easier to ship out its cotton and oil, Houston made the Buffalo Bayou into the Houston Ship Channel, large enough for oceangoing vessels to reach Houston from the Gulf of Mexico. Only two of the country's seaports now handle more shipping—New York and New Orleans.

Today Houston is famous all over the world for its part in space exploration. The Manned Space Center is there. Astronauts are trained at this center. Space capsules are launched at Cape Kennedy, but as soon as they are on their way they are tracked and controlled from Houston.

The city is also famous as a medical center. It is especially well known for heart operations.

Among the sights for Houston visitors, besides the Space Center, are the statue of Sam Houston, the San Jacinto monument, a beautiful hall for music and drama, famous Rice University, fine shops, and the big sports arena called the Astrodome. Forty-five thousand fans can watch a sports event there with no fear of bad weather.

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